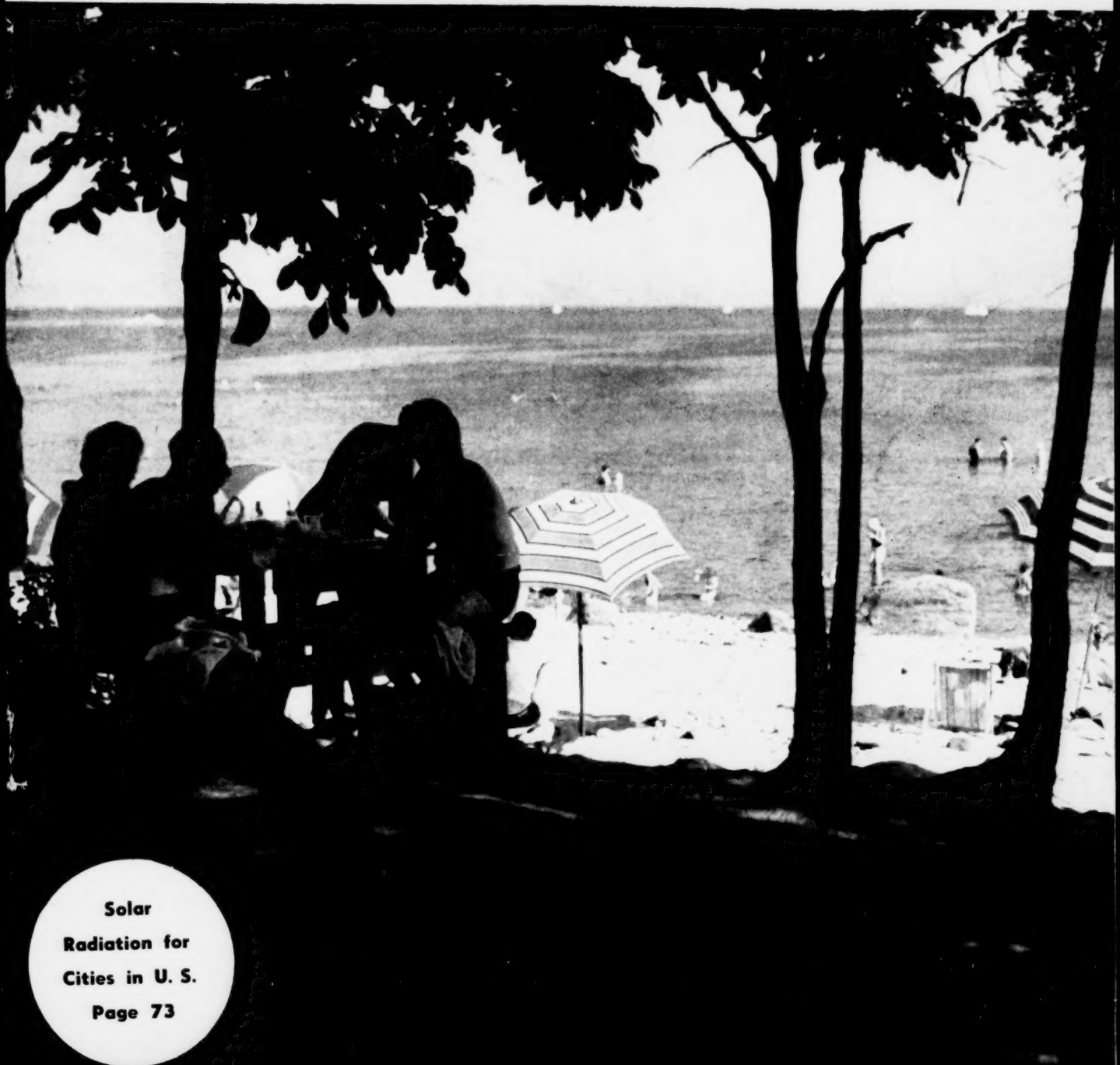
JULY, 1953

HEATING AND VENTILATING

INCLUDING AIR CONDITIONING – PIPING – REFRIGERATION – AIR SANITATION



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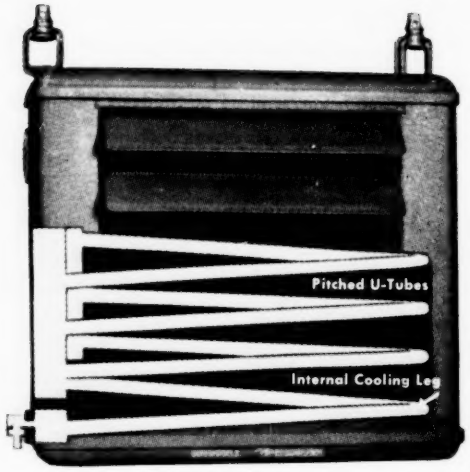
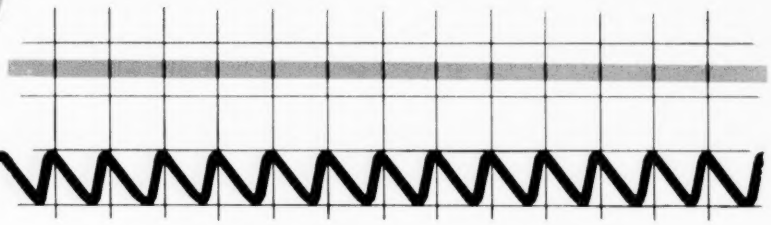


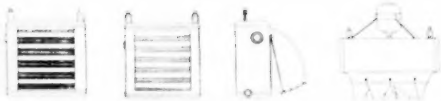
when buying unit heaters

be sure you get this

...not this!



With **THERMOLIER...**
the Grinnell Unit Heater . . . you get
CONTINUOUS RATED CAPACITY



Horizontal Delivery | Textile Model | Velocity Nozzle | Vertical Delivery

THERMOLIER FEATURES

INTERNAL COOLING LEG A Grinnell feature which permits the use of a plain thermostatic trap for draining condensate.

PITCHED U-TUBES Built-in pitch of U-tubes provides complete drainage of condensate and elimination of destructive water hammer.

CONTINUOUS RATED CAPACITY The combination of Thermolier's internal cooling leg and the built-in pitch of tubes assures continuous rated capacity.

BUILT-IN EXPANSION PROVISIONS Every tube is an expansion bend of the U type to allow for independent expansion and contraction of each tube.

TUBE-TO-HEADER CONSTRUCTION Safety and durability assured by unique tube-to-header construction.

EASE OF ERECTION Exclusive with Thermolier are the adjustable swivel couplings which provide an easy, cost-saving method of hanging the unit.

SIMPLE PIPE CONNECTIONS The supply and return piping connections are on the same side to assure compactness, neatness and economy in installation.

MOTORS Thermolier motors are built specifically for unit heater duty. They give maximum operating efficiency with minimum power cost.

The practical advantages of unit heating, of course, are well known. But in order to get *maximum* economy and efficiency, certain engineering and structural features *must be* present in the unit heater of your choice.

Take provisions for draining off condensate. Failure to provide freedom from collected condensate in the heating element can interfere with heat output and adversely affect capacity.

A Thermolier Unit Heater successfully handles this drainage problem with its pitched U-tubes and internal cooling leg, through which all the condensate passes. In fact, condensate cooling is so efficient with Grinnell Thermoliers that a thermostatic trap — the simplest and least expensive of all traps — can be used with every model. Condensate temperature is lowered to the point where the trap is always draining — giving Thermolier Unit Heaters their *continuous rated capacity.*

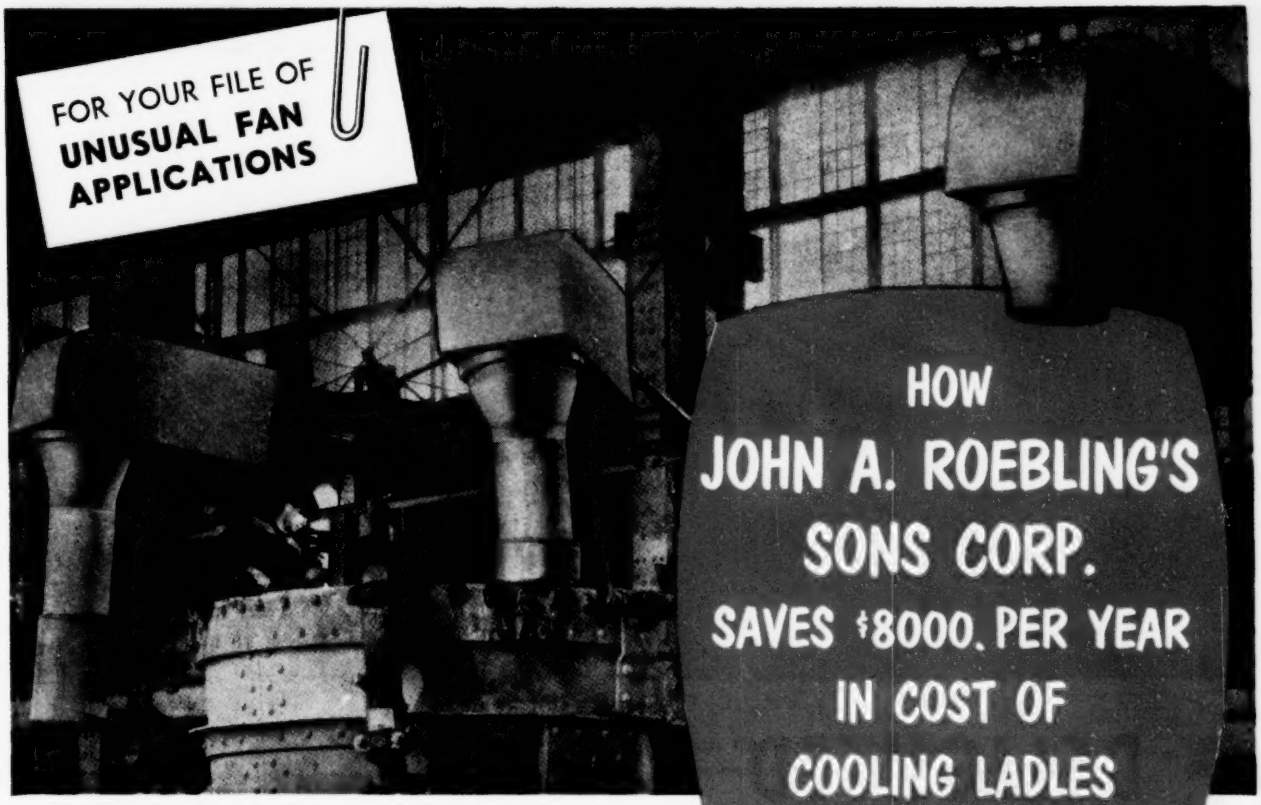
Check Thermolier's advantages at left. For more details, call your local Grinnell distributor — or send for catalog.

GRINNELL

THERMOLIER UNIT HEATERS

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports
Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems



FOR YOUR FILE OF
UNUSUAL FAN APPLICATIONS

HOW JOHN A. ROEBLING'S SONS CORP. SAVES $8000. PER YEAR IN COST OF COOLING LADLES

At the Roebling, New Jersey, mill of John A. Roebling's Sons Corporation, seventeen 45-ton ladles are kept busy in the production of carbon steel, from which the famous Roebling wire rope is made. After each heat, ladles must be cooled down from 2000° F and pouring nozzles installed.

Dissatisfied with the old method of using compressed air for cooling ladles, engineers at Roebling's conceived the idea of trying a DeBothezat "Hy-V" Air Jet to do the job. They selected a "Hy-V" Air Jet with 21" fan wheel and 1½ HP motor which produces 5600 CFM at a nozzle velocity of 4570 FPM, and it worked so well that Roebling has installed four more. Each is mounted on a swinging bracket and is equipped with special nozzle extension so that air is discharged near the bottom of the ladle. Nozzle extension is retractable.

Here's what E. M. Yard, Roebling Combustion Engineer, has to say about the installation: *"Nearly the full capacity of one 200 HP air compressor was previously used to do this job. The use of "Hy-V" Air Jets means a power saving of probably $8,000.00 per year. In addition, the installation of these fan units, at a total cost of about $4,000.00 eliminated the need for additional air compressor capacity which would have cost $16,000.00. These fan units will recover their cost in about six months from power savings alone."*

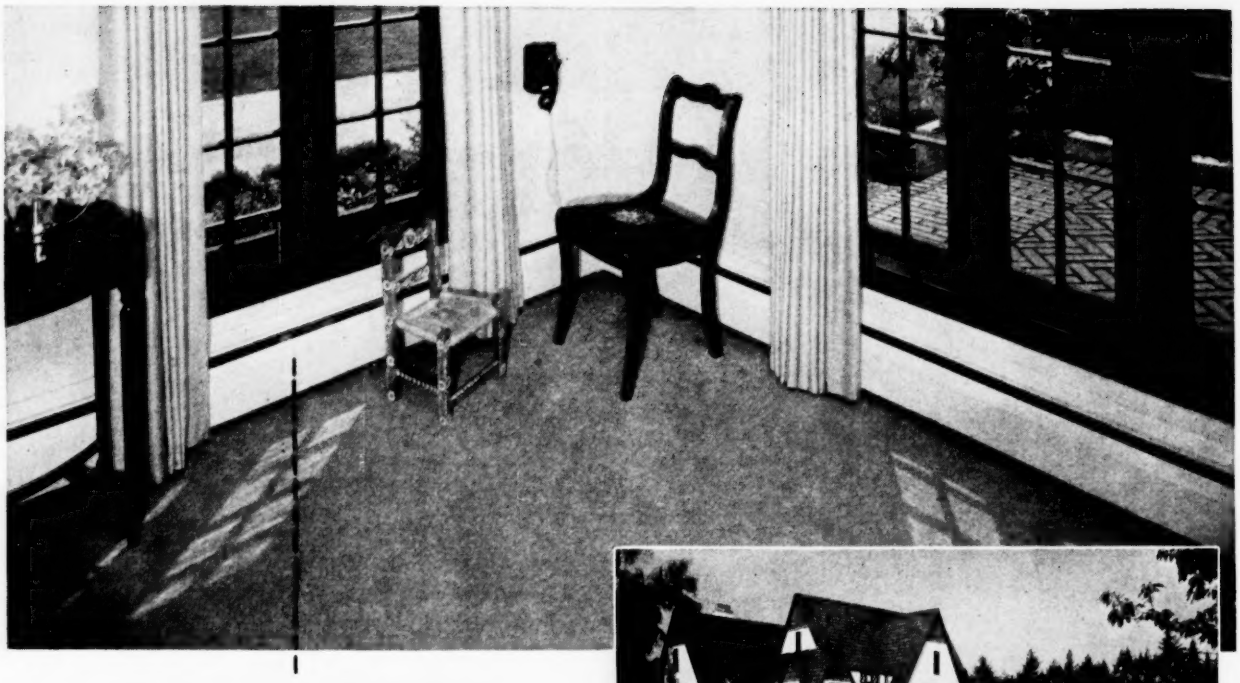
Whether it's a question of cooling people or equipment, "Hy-V" Air Jets do the job efficiently and inexpensively. For detailed information, ask your DeBothezat representative or write our factory, Dept. HV753, for catalog DH-8-51

Certified Ratings

"HY-V" AIR JET
is a 14-blade axial-flow pressure fan which projects a high velocity stream of air as far as 65 feet. Built with fan wheels 18" through 30" in diameter, with nozzle velocities up to 5780 FPM.

DeBothezat Fans

Division of American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS



V. I. Whitney residence, Montesano, Wash., where Forced Hot Water Webster Baseboard Heating has replaced old-fashioned radiators. Heating Contractor: Zimmer Heating Sales and Engineering.

DELIGHTED
with this new Clean Heating
after 25 years with radiators

V. I. Whitney, of Montesano, Wash., was one of the first home owners to discover that an old-fashioned radiator heating system could be transformed with Webster Baseboard Heating.

"Our house was built in 1926 and was considered one of the finer homes in this area," Mr. Whitney says. "We had a hot water heating system with an automatic oil burner and large cast iron radiators. There was a radiator in front of each of the beautiful windows in our large, 34 x 17 ft. living room. It was never possible to have the pretty drapes and lovely carpeting which so many modern homes use.

"We are delighted with this new installation. We have the beautiful effect of full length drapes. Carpeting goes right up to the baseboard. We can place our furniture any place in the room we like. The comfort and satisfaction which we derive from this new method of heating, merely by replacing the radiators and making no other change in our heating, has been remarkable."

Webster Baseboard Heating with forced hot water can be installed in existing homes by your own heating contractor. Call your Webster representative or write us.

Address Dept. HV-7

WARREN WEBSTER & COMPANY
Camden 5, N. J. Representatives in Principal Cities
In Canada, Darling Brothers, Limited, Montreal

Webster
TRU-PERIMETER FORCED HOT WATER
BASEBOARD HEATING

HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

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The INDUSTRIAL PRESS

Also Publishers of
HEATING & PLUMBING EQUIPMENT NEWS
and technical books.

THIS MONTH'S COVER

This beach scene, a Philip D. Gendreau photograph, was selected to emphasize the large amount of solar energy that is available during certain months of the year. For data on solar energy distribution over the United States, see the article commencing on page 73.

Washington News

LORING F. OVERMAN

ALTHOUGH the Excess Profits Tax was the star performer during June in Washington, keeping the audience as well as some of the cast in suspense until the very last, Members of Congress were keeping their eyes on three other things as Independence day approached.

The August 1 target date for adjournment was high on the list, largely because it pinpointed the need for haste in passing "must" legislation. In that grouping, of course, were the inevitable appropriations bills.

Secondly, Congress and the Agencies were getting down to business on long range planning. Included were such topics as a major overhauling of the tax structure, the controls program, the housing outlook, and the need for shipping.

Last but not least came consideration of the defense program, as influenced by new developments in Korea and other parts of the world.

August Adjournment

Congressional leaders were making a serious try for adjournment by August 1, with plans to reassemble in January of 1954. It was obvious that much which the new Administration had hoped to accomplish is not to be finished this year, but Committee Hearings are getting under way early on major projects which will be readied for the 1954 session.

Senator William F. Knowland (R-Calif.), acting Republican Senate leader during the illness-enforced absence of Senator Taft, forecast completion of the following legislation: Extension of the Reciprocal Trade Agreements Act; a bill to simplify customs procedure, and 12 appropriations measures.

Comprehensive Tax Study

If the pro and con discussions of the excess profits tax did nothing else, they served as a dress rehearsal for the extensive hearings pointed toward a stem-to-stern overhaul of the Federal Tax structure. Scores of witnesses classified the EP tax as an initiative-stifling measure. There are indications that hearings before the House Ways and Means Committee on the general subject of tax procedures will reveal many similar instances of inequities and hardships.

The tax discussions which got under way in Washington in mid-June are touted as the first comprehensive study of the sort in 75 years. Covering some two-score of subjects, the testimony is expected to point the way toward a new Administration tax policy for 1954. Hearings are scheduled on a three-day-a-week basis during the remainder of the session.

Among topics docketed for discussion is the so-called "double-taxation" of corporation dividends, first in the form of a corporate income tax, and later in the hands of the shareholder. Another is the proposed preferred treatment for earned income as opposed to investment income. Liberalization of the 26% capital gains tax to encourage business and investment turnover is another topic for study.

Another involves modification of the so-called straight-line method of allowing depreciation on business property, in favor of a quicker writeoff in the earlier years. Further question: should the present 2% penalty for filing consolidated tax returns be removed, and does Section 102 of the Internal Revenue Code, designed to prevent unreasonable accumulation of corporate surpluses, work a hardship on small businesses by forcing them to distribute earnings?

Not all of the subjects under consideration will involve business taxes. Subjects which have been considered inequitable by individuals will also be considered, it is indicated by Chairman Daniel A. Reed (R-N. Y.) of the House Ways and Means Committee.

"The time has come for a tax law that does more than raise revenue," he said. "The important thing is to raise confidence."

Chairman Reed conceded that some of the proposed changes will result in losses to the Treasury for a while. He predicted that in the long run, tax revenues will increase.

Washington observers are urging business people and others to take advantage of the current hearings to let Members of Congress know how the tax structure is affecting the country. If members of the heating, ventilating, air-conditioning and piping industries have tax problems which they feel could be eased by a change in the tax laws, now is the time to make ideas known. Two approaches are suggested:

The problem can be stated, and the solution suggested, in a letter to the House Ways and Means Committee, New House Office Building, Washington, D. C. Or the letter may ask permission to appear before the committee in person. In the latter case the individual should enclose a summary of the ideas proposed, and an estimate of the time required for the personal presentation.

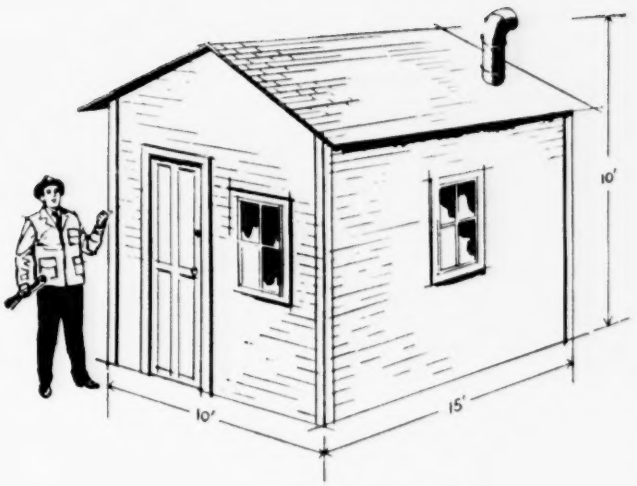
As an early dividend of the hoped-for new tax study, the Commissioner of Internal Revenue has announced that it is now the policy of the Bureau generally to allow depreciation claims made by the taxpayer without question unless there is clear and convincing basis for a change. It is also specified that careful consideration be given to facts and arguments presented by the taxpayer with respect to obsolescence, as well as to his repair and maintenance policy. Referral to a valuation engineer is to be permitted only in cases where proposed depreciation changes are material and no agreement can be reached between the revenue agent and the taxpayer.

Although many taxpayer problems must await results of the overall survey, the present relaxation is being accepted by many as a step in the right direction.

Materials Controls Extended Two Years

At press time, Senate and House conferees had reached agreement on a bill (S1081) extending the materials

There's a MILLION square feet of Insulation stored in that 10' x 15' shack!



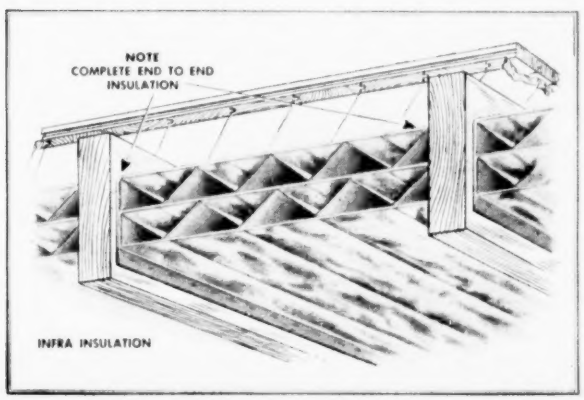
ORDINARY INSULATION WOULD TAKE 140 SUCH SHACKS

Storage problems and waste are drastically reduced for contractors, builders and dealers, both at the building site and on their own premises, when they use multiple accordion aluminum insulation. While 1000 sq. ft. of ordinary insulation sometimes weighs a ton and usually occupies 25 cartons of 175 cu. ft. in all; one standard carton of multiple accordion aluminum, such as Infra Type 4, holds 1,000 sq. ft., weighs 46 lbs., and occupies 1¾ cu. ft. Warehousing, transportation and handling bills are naturally insignificant in comparison.

Multiple accordion aluminum's slight mass, scientific compartmentation, and zero permeability to water vapor are decisive in protecting buildings against destructive condensation. The "warm" side of multiple accordion aluminum insulation, and each component layer almost immediately assumes the temperature of the air in contact. The "cold" side remains a trifle warmer than the air *it* contacts, thereby raising its dew-point. With no dew-point attainable, condensation is prevented.

The light-weight but tough aluminum sheets, and the automatic and permanent compartmentation combine to bar unwanted heat loss or intrusion. The metallic sheets throw back the heat rays at a 97% rate, emit at 3%. Their insignificant mass and the nonconductivity of the air layers prevent conduction flow. The construction has 5 integral barriers to convection.

There is now a new standard Infra Insulation (the commercial form of multiple accordion aluminum), improved to form a blanket of uniform depth between studs and joists, which completely covers the spaces between.



COST OF NEW INFRA INSULATION INSTALLED
in new construction between wood joists,
Material with Labor

Type 6—Si under 9½¢ sq. ft.
Type 4—Si under 7½¢ sq. ft.
Type 4—S Jr. under 7½¢ sq. ft.

INFRA INSULATION INC., 525 Broadway, New York N.Y.

Infra Insulation, Inc.,
525 Broadway, New York, N. Y., Dept. V-7
Please send me free ☐ Schwartz's "Simplified Physics"; ☐ Infra samples; ☐ Infra prices.
Name_____
Firm_____
Kind of business_____
Address_____

controls and production expansion program for two years, until June, 1955. The measure also creates a new Small Business Administration to look after the interests of small manufacturers.

It was expected that both Senate and House would approve the bill in plenty of time to provide President Eisenhower with authority which would otherwise expire on June 30. Left out of the bill is the controversial proposal for a 90-day freeze of prices, wages, rents, and credit terms in emergencies. Also missing are restrictions on imports of dairy products, peanuts, rice, and selected fats and oils. Added is authority for the newly created Small Business Administration to make direct loans up to $100,000, subject to strict procedural requirements, and to take over government contracts and farm them out to small manufacturers.

The conference-approved measure authorizes the President:

(1) To continue until June 30, 1955, controls over scarce defense materials. Allocations are to be confined to defense contractors where possible, unless the President finds that failure to allocate to civilian consumers would produce appreciable hardship.

(2) To continue until June 30, 1955, the present authority in Title III of the (Defense Production) Act to make V loans and to enter into long term contracts with producers for the delivery of scarce materials or products to the government, with added provisions extending the contract period to June 30, 1963, and shifting surplus materials to the national strategic stockpile.

Housing Law Changes Asked

Witnesses appearing before the Senate and House Banking Committees in opposition or in support of proposed new housing legislation, presented widely varying viewpoints as to effects of some of the proposals. Under consideration by the House Committee is HR 5667, which would permit FHA to set higher rates on military and defense rental housing mortgages insured under Titles VIII and IX of the National Housing Act. The statutory maximum would go to 4½% from the present 4%. Another provision of the House bill would permit FHA to raise to 4½% the interest rates on cooperative housing mortgages insured under Section 213 of the Housing Act, and authorize a boost to 5% for mortgages covering individual homes in FHA cooperative projects.

The Senate version of the Housing Bill (S2103), would extend certain provisions of the act until June 30, 1954, but would make no changes in interest rates or maturities. The Senate has already approved the higher interest rates in another bill (S1993).

The differences of opinion arose over the probable effects of increased rates. One of the nation's largest builders (William J. Levitt, Levitt & Sons Co., Manhassett, N. Y.), predicted a drastic slowdown in residential building unless provision is made for lower down payments. A spokesman for the National Association of Home Builders also urged the committee to reduce down payments and extend mortgage maturity periods, so as to encourage the sale of houses.

The general counsel of the Mortgage Bankers Association said that his group does not feel certain that lower down payments would bring out more money for mortgage purposes.

Federal Housing Administrator Cole said the Administration had considered asking Congress to fix lower down payment requirements on FHA-insured housing but decided the time is not yet ripe for it. He told the committee there has not been a sufficient change downward in the number of housing construction starts to make this action necessary. Administrator Cole asked both committees to authorize another $1.5 billion in FHA commitments, and to extend the FHA Mortgage Insurance Program for one year.

Shipping Needs Outlined

The increasing importance of air-conditioning in ship construction lends interest to a recent official statement that the U. S. merchant fleet needs an immediate program of considerable scope. In the event of war, according to a Defense Department spokesman, the national interest would require 214 additional merchant vessels. Suggested are 165 cargo ships, six passenger ships equivalent to the P-2 class, and 43 tankers equivalent to the T-5 class. The estimate of probable needs was made in protesting a $40 million cut in funds earmarked in the Department of Commerce budget to subsidize the construction of new merchant vessels.

Reorganized ODM Shaping Up

By taking no action to block the President's Reorganization Plan No. 3, Congress permitted a new Office of Defense Mobilization to come into being on June 12. The new ODM was created to take over the stockpiling authority formerly vested in the Munitions Board, and the mobilization planning duties of the National Security Resources Board. Arthur S. Flemming was named by the President to head the ODM, subject to Senate confirmation.

The organization is to have a deputy director and six divisions handling financial policy, economic stabilization, nonmilitary defense, production requirements and programs, materials, and manpower. Director Flemming is hoping to find industry people to head up each of the divisions for periods of six months to a year.

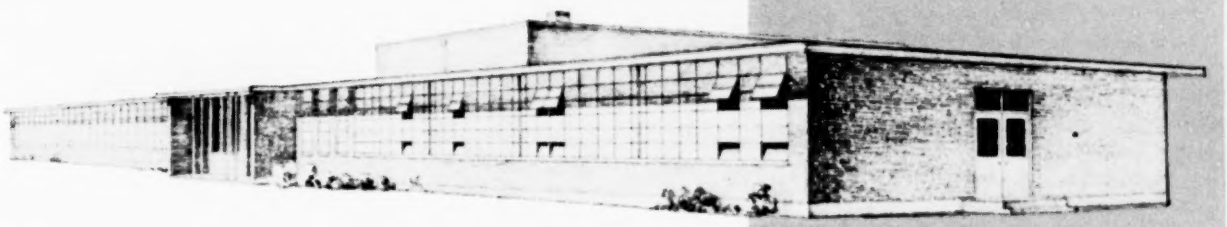
NPA Revokes CMP Regulations

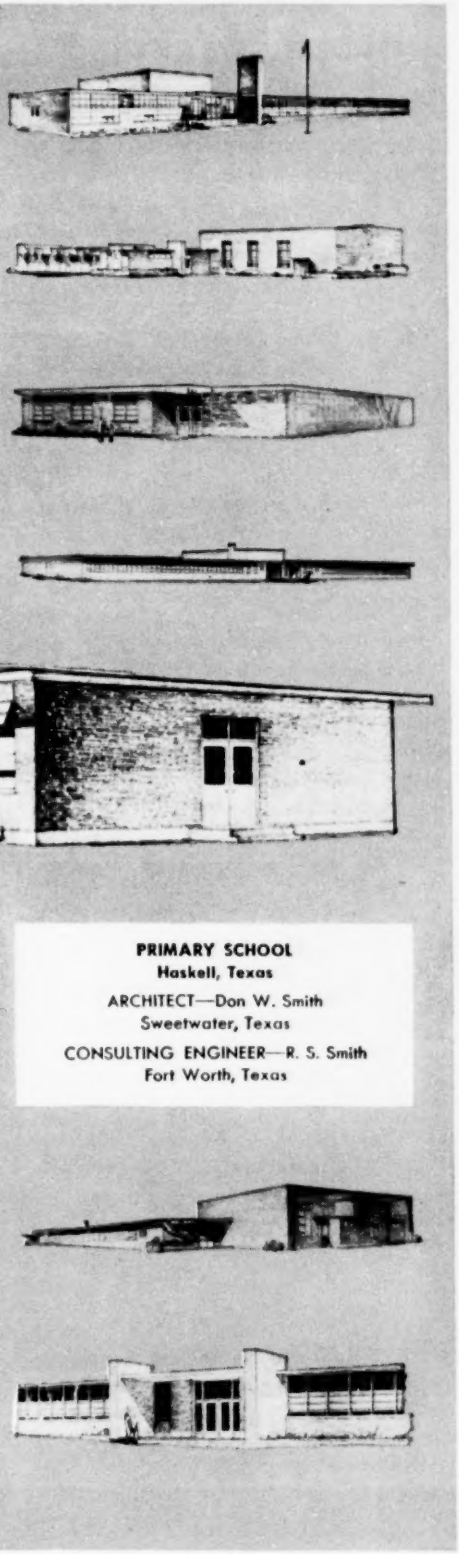
The National Production Authority has announced the revocation of all the remaining Controlled Materials Plan regulations, effective July 1. Those revoked were CMP Reg. 1 (basic rules); CMP Reg. 3 (defining the preference status of delivery orders for controlled and non-controlled materials); CMP Reg. 4 (rules for distributors' deliveries of controlled materials), and CMP Reg. 6 (basic rules for most construction). CMP Reg. 2 was revoked on May 1, and Regs. 5 and 7 were to expire on July 1.

Comparable provisions for support of defense and atomic energy programs are contained in Defense Materials System Regulations 1 and 2, the latter applying to construction.

NPA has also lifted controls from eight alloying metals covered by Order M-80—boron, calcium, manganese, silicon, titanium, tungsten, vanadium, and zirconium. Controls remain effective, pending further study, for chromium, cobalt, columbium, molybdenum and nickel. These controls include a 60-day inventory limitation.

This West Texas round-up of RADIANT HEATED SCHOOLS marks BYERS WROUGHT IRON PIPE as top "brand" for protection





PRIMARY SCHOOL
Haskell, Texas
ARCHITECT—Don W. Smith
Sweetwater, Texas
CONSULTING ENGINEER—R. S. Smith
Fort Worth, Texas

The long established record of Byers Wrought Iron pipe as the number one choice for radiant heated schools receives another vote of confidence in West Texas. Within a 75 mile radius of Sweetwater, 10 elementary school buildings, all built in the last three years, are safeguarded against premature radiant heating failure with Byers Wrought Iron pipe.

The drawings illustrated here are representative of the modern, functional architectural treatment of these schools, designed by Don W. Smith.

Byers Wrought Iron pipe has maintained its leadership in radiant heating because of its unusual combination of advantages. It is readily formed and welded, which speeds and simplifies installation. Its emission rate is high. It expands and contracts at practically the same rates as concrete and plaster, and so can be safely embedded in these materials. It has ample mechanical strength to withstand damage during installation periods. And its corrosion resistance under similar operation conditions has been demonstrated in hundreds of installations, over periods of many years.

Our bulletin, BYERS WROUGHT IRON FOR RADIANT HEATING, gives the complete story. Write for your copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, New York.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

BRIEFLY STATED

• Two new vice presidents were elected by the directors of Dravo Corp. at the company's annual organization meeting April 15. Also elected were a new treasurer and a controller. The vice presidents, both directors of the corporation, are John K. Beidler, general manager of the Machinery Division, and Louis P. Struble, Jr., general manager of the Keystone Division. Clifford A. Hill, formerly controller, was elected treasurer, and Edward T. Fitch was named controller.

• Morrison Steel Products, Inc., has announced the appointment of Jack Searls as manager of product sales, a newly created position. Mr. Searls was formerly vice president in charge of sales for the White-Rodgers Electric Co. of St. Louis. Prior to his joining White-Rodgers in 1947, he was district sales manager of the Emerson Electric Manufacturing Company of St. Louis.

• Dole Refrigerating Co., Chicago, announces the appointment of Andrew P. Boehmer as chief engineer and William C. Mueller as advertising manager. Mr. Boehmer was recently director of the Power Laboratory in the College of Engineering of the University of Iowa. Mr. Mueller served for ten years with Kraft Foods Co. in Chicago as an advertising manager and was appointed director of public relations of the Chamber of Commerce at San Diego after his discharge from recalled Naval Service.

• General Controls Co., Glendale, California, manufacturer of automatic controls for home and industrial use is establishing a new department for study and analysis of customer requirements in the design and development of new products. The new department will supplement the work of regular engineering divisions of the company and will be headed by H. A. McIntosh.

• Dr. Ernest H. Peabody, founder and president of Peabody Engineering Corp., New York, N. Y. announced the appointment of Eric G. Peterson to executive vice president. Mr. Peterson, graduate of Stevens Institute of Technology, has been with Peabody Engineering since 1928.

• At a special meeting of the board of directors of American Radiator & Standard Sanitary Corp., Joseph A. Grazier was elected acting president of the corporation to serve as its chief executive officer. This action was taken because of the continued illness of Theodore E. Mueller, president of the corporation. Mr. Grazier is now executive vice president and a member of the board of directors and its executive committee.

• At the Annual Meeting of the National Association of Fan Manufacturers, Inc., held in Absecon, New Jersey, May 12th and 13th, 1953, the following officers were elected for the ensuing year: J. M. Birkenstock, president; R. A. Wasson, vice president; and L. O. Monroe, secretary-treasurer. Mr. Birkenstock is general manager of the Green Fuel Economizer Co., Inc. Mr. Wasson is vice president and general manager of the Clarage Fan Co.

• Appointment of the Nelson Stud Welding Division of Gregory Industries, Inc., as a national distributor for the Remington stud driver and fastener studs was announced by Remington Arms Co., Inc., Bridgeport, Conn., at a dinner given by the Lorain Chamber of Commerce to mark the fifth anniversary of the Gregory Industries' acquisition of the stud welding business.

• Election of E. M. Swartz as vice president, United States Radiator Corp. has been announced. Mr. Swartz started his career with United States Radiator Corporation in 1935 as manager of the Bristol, Pennsylvania, plant of the Company's Pacific Steel Boiler Division. In 1951 he was made General Superintendent of Steel Plants.

• Norman F. Sorgenfrei has been appointed assistant sales manager for the C. A. Dunham Company. Previous to his association with Dunham, Mr. Sorgenfrei was with Maid-O'-Mist as sales manager, H. A. Thrush & Company and American Radiator-Standard Sanitary Corp.

• A new product tag is announced by the Propeller Fan Manufacturers' Association, Detroit 26, Mich. In use by member companies, the tag is designed for attachment to the residential and industrial fans manufactured by association members. The cover of the tag carries the copyrighted Certified Ratings label which signifies that the fan has been tested and rated in accordance with United States Department of Commerce Commercial Standard CS 178-51. The inside copy on the new three-color tag is an explanation of air delivery ratings and fan performance standards plus some suggestions for proper care of the fan.

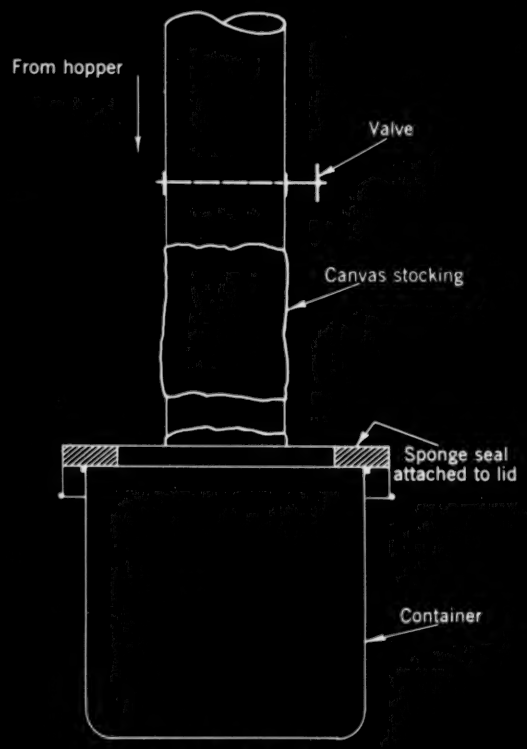
• The board of directors of The Emerson Electric Manufacturing Co. announces the election of William S. Snead as president and chairman of the board and John A. Driy as executive vice president. These changes are effective immediately and are occasioned by the untimely death of the late Oscar C. Schmitt.

• Carroll M. Baumgardner has been named a director in the manufacturer division of the Oil Heat Institute. Mr. Baumgardner is vice president for sales of the National Radiator Co., Johnstown, Pa. This new responsibility was given to Mr. Baumgardner during the recent Insitute meeting in Chicago.

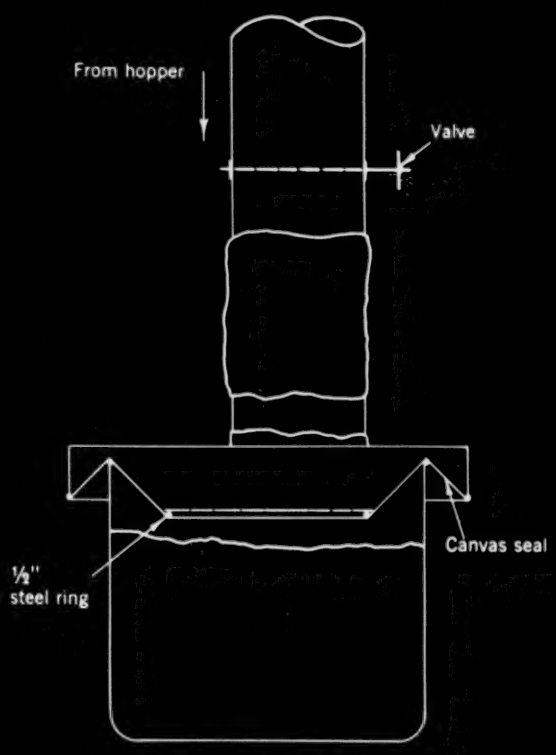
• At the 64th Annual Convention of the Heating, Piping and Air Conditioning Contractors National Association, Robert W. Lawinger was elected president for the 1953-54 term. Mr. Lawinger, president of S. J. Reynolds Co., Inc., Chicago, succeeds William W. Murray, Jr., head of Almirall & Co., Inc., New York. The new vice president of HPACCNA is J. DeWitt Morrow, president of The Warren Co., Inc., Houston, Texas. Succeeding Mr. Morrow as treasurer is Herman W. Goldner, president of Herman Goldner Company, Inc., Philadelphia.

• Richard G. Ray, youngest of four Ray brothers active in the management of General Controls Co., Glendale, Calif., has been named vice president in charge of manufacturing and will retain his former responsibilities as plant superintendent.

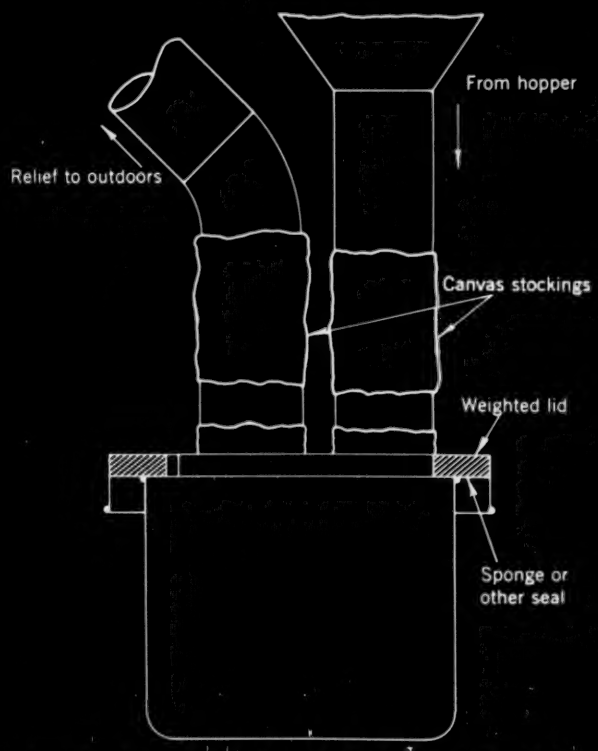
DUST CONTROL FROM HOPPERS



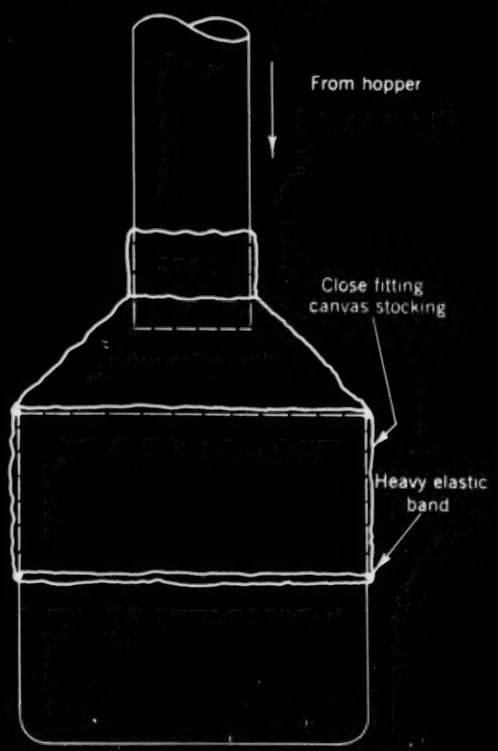
SPONGE SEAL TYPE



WEIGHTED CANVAS SEAL



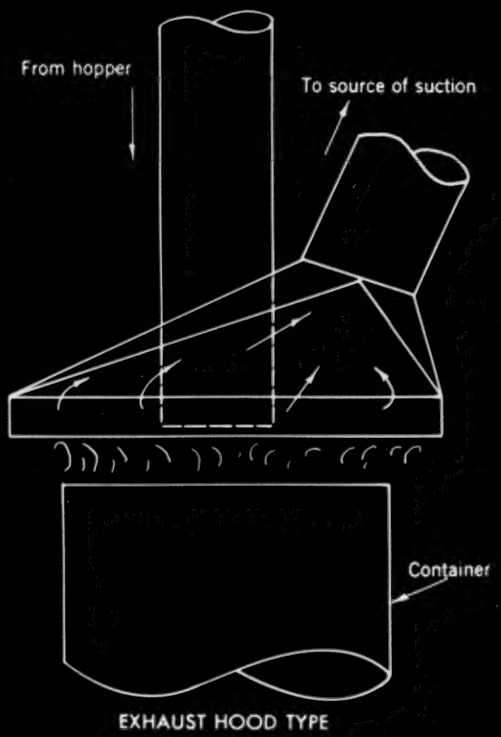
RELIEF TYPE - DISPLACED AIR ESCAPES TO OUTDOORS



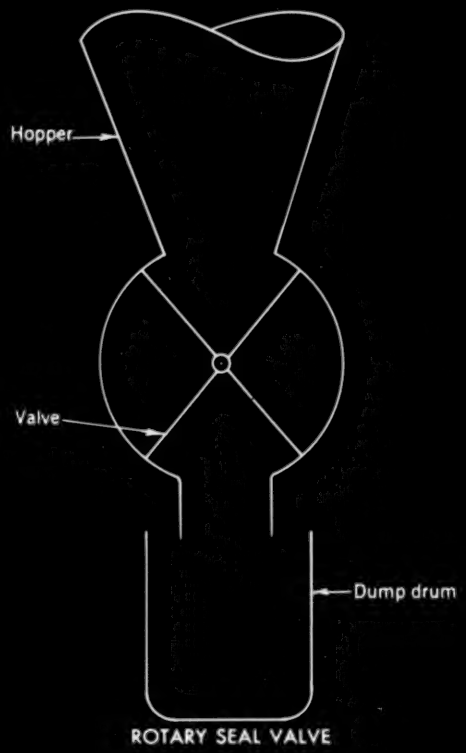
CONTAINER STOCKING TYPE

HEATING AND VENTILATING'S DETAIL SHEET

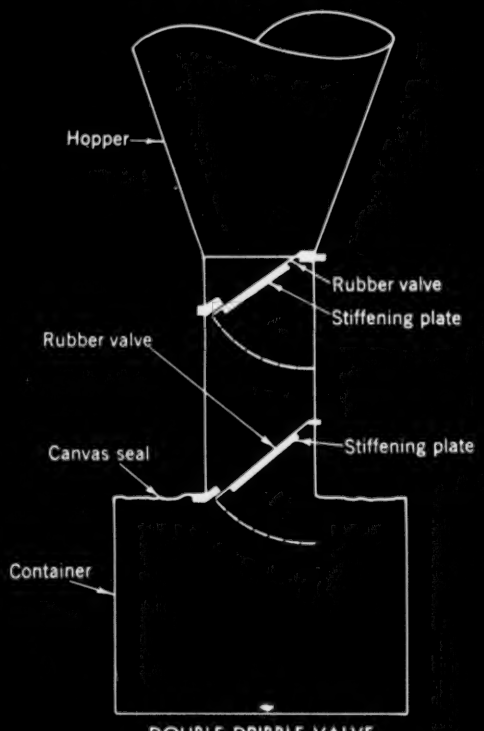
DUST CONTROL FROM HOPPERS



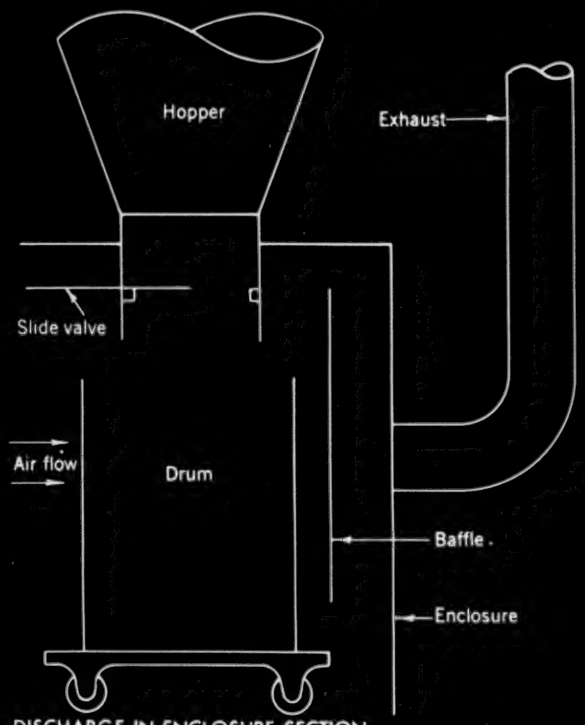
EXHAUST HOOD TYPE



ROTARY SEAL VALVE



DOUBLE DRIBBLE VALVE

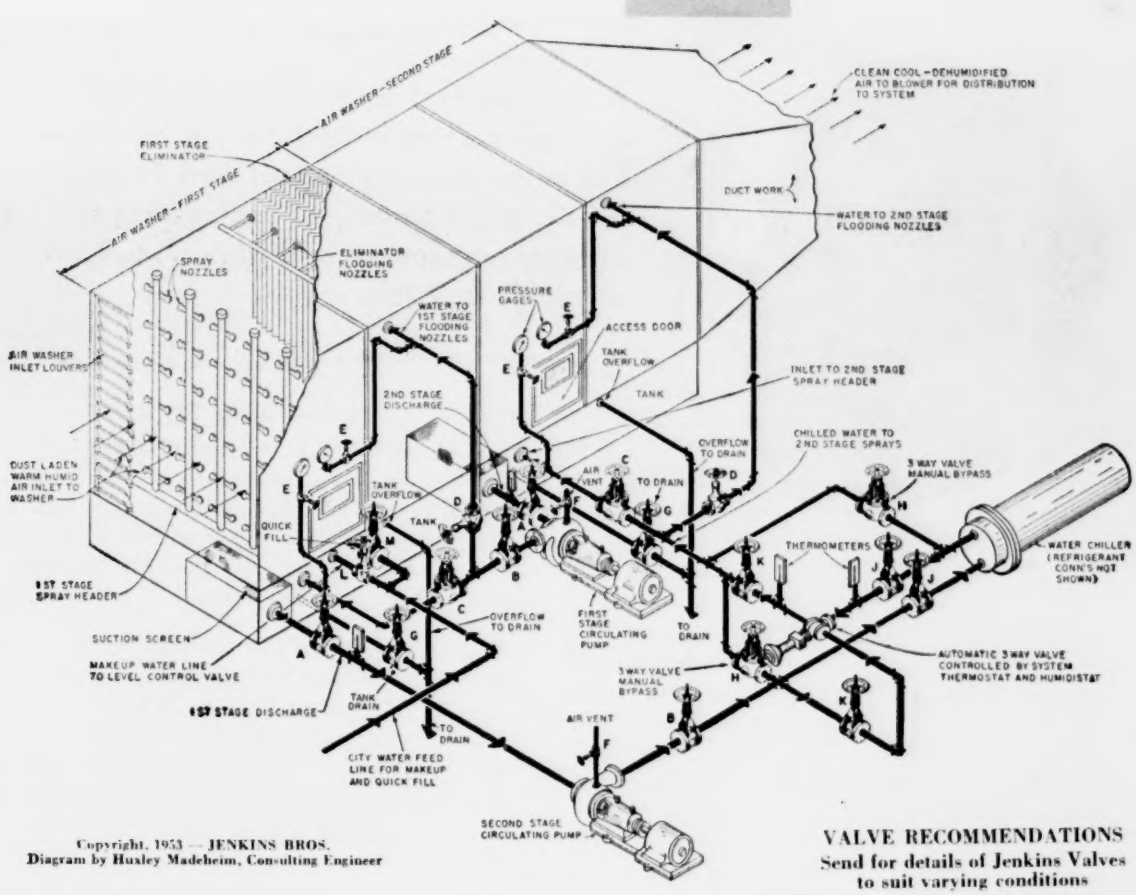


DISCHARGE IN ENCLOSURE SECTION

SKETCHES THROUGH THE COOPERATION OF
F. F. KRAVATH AND DR. LESLIE SILVERMAN

HEATING AND VENTILATING'S DETAIL SHEET

JENKINS PRACTICAL PIPING LAYOUTS 66



Copyright, 1953 — JENKINS BROS.
Diagram by Huxley Madeheim, Consulting Engineer

How to plan PIPING CONNECTIONS FOR AN AIR-WASHER AIR CONDITIONING SYSTEM

The air washer air conditioning system illustrated is a two-stage installation designed to cool, dehumidify and clean air for non-industrial (comfort) purposes.

Water from a chiller, sprayed through second-stage nozzles, picks up heat from the air stream. This water is collected at the bottom of the tank and, still at a temperature below the dew-point of the entering air-stream, is sprayed through the nozzles of the first stage. Here, too, it cools and dehumidifies the air. The water is then pumped back through the chiller and the cycle is repeated.

Excess moisture is removed between stages by a series of baffles which set up abrupt directional changes in the air flow, causing any droplets of water suspended in the air stream to drop out. Separate water spray keeps the baffles wet to collect dust and dirt from the air stream. Final air condition is automatically controlled by proportionate mixing of chilled and return water by means of a three way valve.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17.

Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Simply ask for Piping Layout No. 66.

VALVE RECOMMENDATIONS
Send for details of Jenkins Valves to suit varying conditions

Code	Quan.	Jenkins Valve	Services
A	2	Fig. 651-A, I.B.B.M. Gate	Pump Suction Shutoff
B	2	Fig. 651-A, I.B.B.M. Gate	Pump Discharge Shutoff
C	2	Fig. 142, I.B.B.M. Globe	Spray Header Control
D	2	Fig. 956, Bronze Globe	Flooding Nozzle Control
E	4	Fig. 741-G, Bronze Needle	Pressure Gage Control
F	2	Fig. 741-G, Bronze Needle	Pump Air Vents
G	2	Fig. 651-A, I.B.B.M. Gate	Tank Drains
H	2	Fig. 142, I.B.B.M. Globe	3 Way Valve Manual By Pass
J	2	Fig. 651-A, I.B.B.M. Gate	Water Chiller Shutoff
K	2	Fig. 651-A, I.B.B.M. Gate	3 Way Valve Shutoff
L	2	Fig. 47, Bronze Gate	Feed to Level Control
M	1	Fig. 651-A, I.B.B.M. Gate	Tank Fill Valve for Start up

JENKINS VALVES
LOOK FOR THE DIAMOND MARK
SINCE 1864 TRADE JENKINS MARK

Jenkins Bros

Here's Help on Your

Allis-Chalmers application engineering help plus coordinated design of Allis-Chalmers motors, control and *Texrope* V-belt drives saves you engineering and installation expense and time . . . assures a trouble-free job.

AIR CONDITIONING CONTRACTORS LIKE Allis-Chalmers complete drives because they can save money and still assure the customer of a top quality job without service problems. Allis-Chalmers District Office representatives understand the problems of air conditioning contractors and offer them help in engineering exactly the right drive for the application. Since all parts of the Allis-Chalmers drive are of coordinated design and manufacture, they match up and fit together quickly and easily. And buying from a single source is less trouble . . . means that all components arrive on the job together, ready to be installed.

Nation-wide Stocks

Allis-Chalmers District Offices and Authorized Distributors maintain adequate stock of all equipment commonly used in air conditioning installations. No matter where you are located, most items can be delivered within 24 hours. An efficient warehouse inventory system can locate hard-to-get items in a few hours.

Certified Service

Nearly every industrial area in the country has one or more Allis-Chalmers Certified Service Shops . . . independent service shops which meet Allis-Chalmers high standards for modern equipment, efficient methods and business integrity. These shops assure your customer of factory-approved parts and service.

For lower engineering and installation cost . . . for one reliable guarantee of satisfaction on the complete drive unit . . . for quick delivery and top notch service . . . make your next drive Allis-Chalmers.

Send for Free Engineering Literature

Motors

- ☐ Handy Guide to Motor Selection 51B6052
- ☐ Squirrel-Cage Motors 51B6210

Control

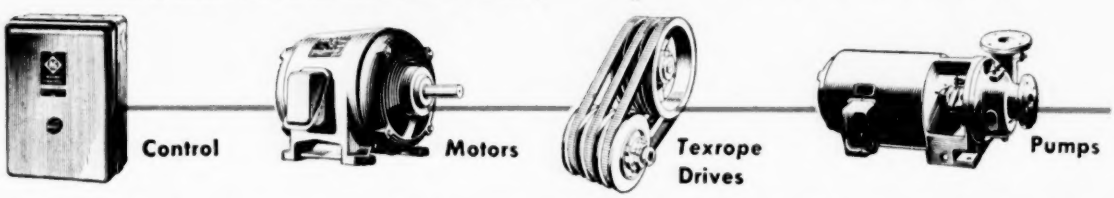
- ☐ Handy Guide to Starters 14B7733
- ☐ Reduced-voltage Starters 14B7215

Texrope Drives

- ☐ Handy Guide to *Texrope* Drives 20B6051
- ☐ *Vari-Pitch* Drive Engineering Data 20B7499

Allis-Chalmers, Milwaukee 1, Wisconsin

COMPLETE SERVICE *from power line to machine*



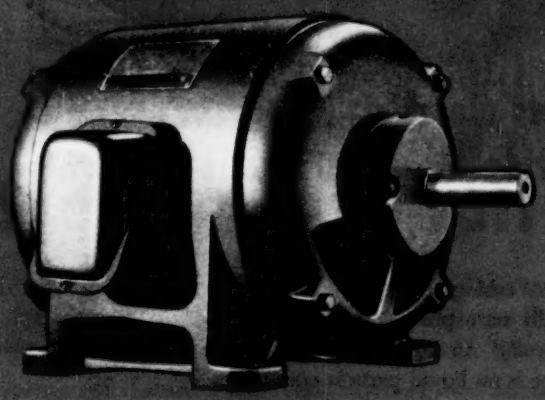
Drive Problems

ALLIS-CHALMERS

COMPLETE DRIVES

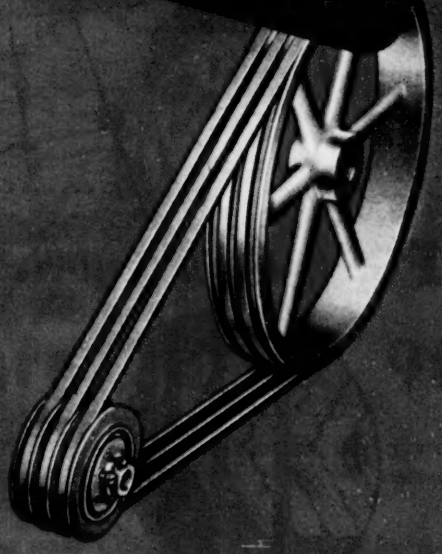
Motor Control

Allis-Chalmers motor control is available for most air conditioning applications from Size 0 up. Allis-Chalmers builds many types of variable speed control for ac and dc wound-rotor motors. These are applied to pumps, fans and other machines requiring speed control.



Motors

Allis-Chalmers general purpose and special motors meet almost any air conditioning need from ½ hp up. Types include squirrel cage, wound rotor and dc for single or multi-speed operation. These motors are available with a full range of torque characteristics and a wide choice of enclosures and mounting methods. Many air conditioning contractors are now recommending Allis-Chalmers fin-type totally-enclosed, fan-cooled motors because of their extremely low maintenance costs. Protected from dirt and moisture, these motors last longer and require less service than standard open types.



Texrope Drives

Texrope V-belt drives, the original multiple V-belt drive, are available in complete range of sizes and types, both fixed and variable speed. More and more air conditioning installations are being equipped with *Vari-Pitch* drives for easier system balancing, quicker speed changes for seasonal adjustments and more versatile performance of all types of equipment. The small extra cost is more than paid back by reduced adjustment and maintenance time. With either Stationary Control or Motion Control *Vari-Pitch* sheaves, speeds can be accurately adjusted quickly and easily over a wide range.

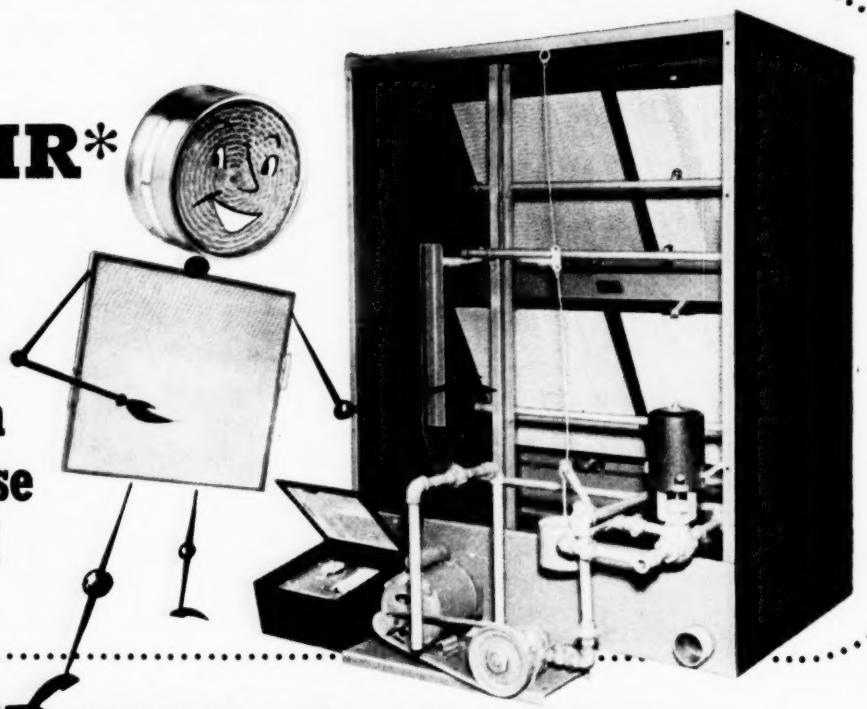
A-4038

Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

only FAR-AIR* gives you completely automatic air filtration with all these advantages!



FAR-AIR Self-Washing filters clean air better... provide these automatic features, too!

FAR-AIR Self-Washing filters give you more efficient, more dependable service. That's because FAR-AIR's exclusive herring-bone-crimp media design permits progressive loading and free air flow.

Find out today about completely *automatic* air filtration.

Washing, drying and oiling is controlled electrically on a pre-determined time schedule... *automatically!* Air cleaning efficiency remains constant. There is no liquid particle entrainment.

Water and dirt are flushed directly to sewer... *automatically!* There is no messy oil sump to collect sludge and create a fire hazard. Maintenance man-hours are reduced. Built-in controls guard against fire ... *automatically!* These are Far-Air features:

No entrainment • No sludge—no oil sump
Automatic fire control • Minimum maintenance
Easy installation

FAR-AIR FILTERS

"Better by Farr"

*Trade Mark Reg.

FARR COMPANY

Manufacturing Engineers

CHICAGO · LOS ANGELES · NEW YORK

Mf'd under license by Control Equipment Co., Ltd. Montreal, Canada

MAIL COUPON NOW FOR COMPLETE INFORMATION!

Farr Company, P. O. Box 10187, Airport Station, Los Angeles 45, California

Please send me information on FAR-AIR Self-Washing filters.

I would ☐ would not ☐ like a Farr Field Engineer to discuss my air filtration problem with me.

Name _____ Title _____

Company _____

Address _____

Steak was really "rare" in the 90's

At the turn of the century the "butcher's wagon" was a familiar sight. For many rural families it was their only meat market.

Electric refrigeration has revolutionized food marketing, but equally important are the benefits to public health. Now, you can keep your steaks in the "pink of condition" for one day or fifty-two weeks, as you choose.

The volume production of dependable and efficient Emerson-Electric Hermetic Motors has been a contributing factor in making modern refrigerators and food freezers economically sound investments for millions of Americans.

Leading makers of motorized products for the farm, home, business and industry depend on Emerson-Electric's 62 years of motor building experience. For information on this complete line of standard motors in ratings from 1/20 to 5 h.p., and hermetic motors from 1/8 to 20 h.p., write:

THE EMERSON ELECTRIC MFG CO., St. Louis 21, Missouri

MODERN LIVING **IS POWERED WITH** ELECTRIC MOTORS

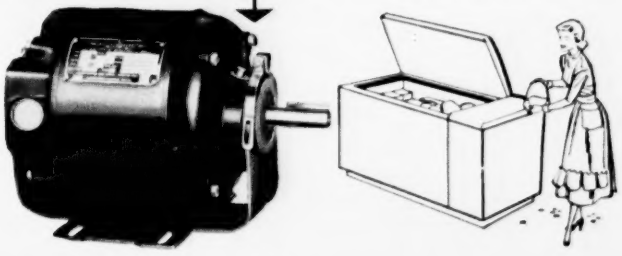
EMERSON-ELECTRIC'S unique

Twin-gineering

SERVICE

solves your power problems

Our engineers are eager to work with yours in designing and providing the correct motor for contemplated new or improved appliances or equipment. "TWIN-GINEERING" saves costly engineering "back-tracking," and may suggest short cuts and product improvement. Write today for Bulletin No. 413.



EMERSON ELECTRIC

MOTORS • FANS APPLIANCES

LEADERS IN THE MOTOR AND FAN INDUSTRY SINCE 1890

Guaranteed TO SHUT TIGHT*

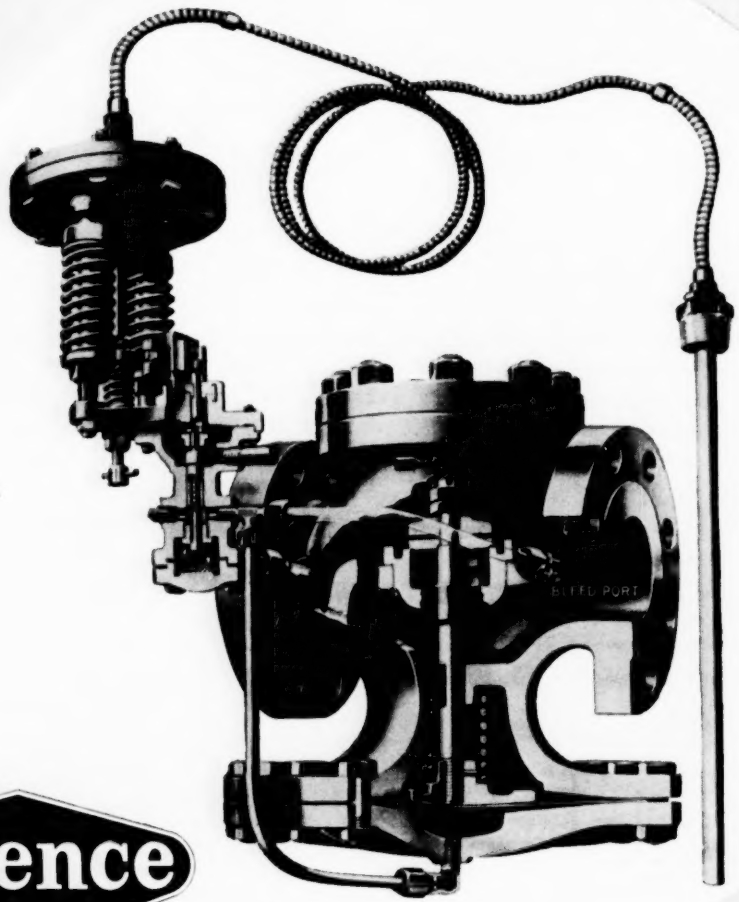
*When equipped with a SECO Metal Seat and Disc on steam service and protected by an approved Strainer, a Spence Regulator is guaranteed to shut tight when the demand for steam ceases.

Expensive steam leaks due to a lack of absolutely tight shutoff are eliminated in Spence Temperature Regulators. Here is why we can make such a guarantee:

First, our temperature regulators are of the single seat design. Seats and discs are made of durable SECO Metal. More than 20 years experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

These plus other design features explain why Spence Temperature Regulators function dependably and accurately year after year without requiring expensive repairs or special attention.

Want more facts? Write for Bulletin T50 giving full details.

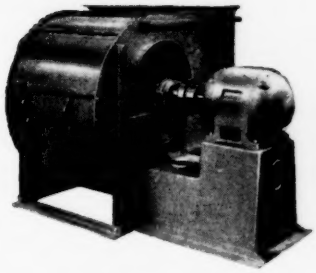


SPENCE
TYPE ET150
Temperature
Regulator

Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

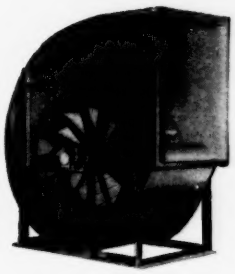
THE FAN for your JOB IS ON THIS PAGE



DRAFT FANS

"Buffalo" mechanical Draft Fans are helping turn out low-cost steam in plants and major utility stations everywhere.

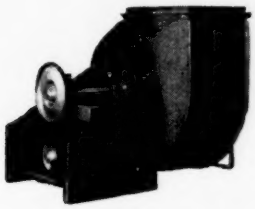
BULLETIN 3750



LIMIT-LOAD FANS

"Buffalo's" most widely used ventilating and air conditioning fans. 600 to 500,000 cfm capacities. Quiet, non-overloading, efficient.

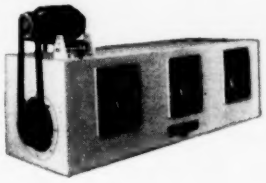
BULLETIN 3737



BELTED VENT SETS

Non-overloading ventilating fans for duct or free air delivery. Extra quiet.

BULLETIN 3720



SHORTBOY VENTILATING SETS

Quiet, efficient, vibration-free fans. Wheels mounted on hollow shaft.

BULLETIN 3701

"Buffalo" Fans give "extras" in performance for two reasons: First, the line is so complete that you can pick — with mathematical accuracy — the fan to give you best possible results on almost any air moving job you could name. Second is the "Q" Factor, or inbuilt quality that "Buffalo" engineers have always insisted on. Why not have us mail you Bulletins on the right fans for **your** air job—from the complete line shown here?

"Buffalo" FIRST FOR FANS

. . . and for satisfaction in your PUMPING applications

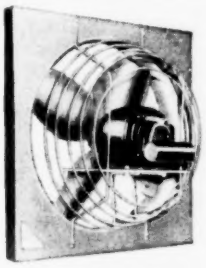
. . . check into "Buffalo" Centrifugal Pumps. Every industry depends on them. There is one to fit **your** hydraulic conditions. Representatives in principal cities.

BUFFALO FORGE COMPANY

480 Broadway Buffalo, N. Y.

Publishers of FAN ENGINEERING Handbook

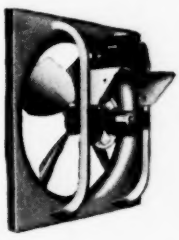
Sales Representatives in all Principal Cities



New! NV-BREEZO FANS

Their specially-shaped four-blade wheel gives high efficiency even against system pressures of ¼" and ½". 8" to 24" sizes.

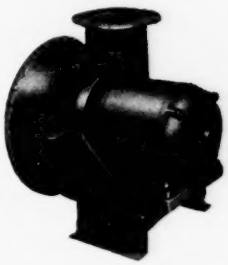
BULLETIN 3865



New! BELT-AIR FANS

Quiet, sturdy fans to move a lot of air at negligible cost. Heavy-gauge die-stamped blades and panel.

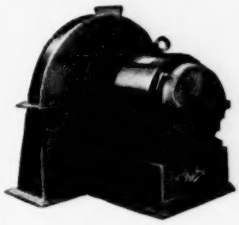
WRITE FOR BULLETIN



"CB" PRESSURE BLOWERS

Up to 2¼ psi, single stage with these husky, space-saving units!

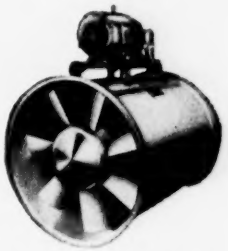
BULLETIN 3553



"CC" PRESSURE BLOWERS

In sizes for up to 4 psi, and capacities up to 75,000 cfm. Complete range of sizes, extra heavy-duty construction.

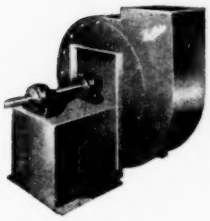
BULLETIN 3553



AXIAL FLOW FANS

Compact, light, highly efficient ventilating fans for light duty.

BULLETIN 3533



INDUSTRIAL EXHAUSTERS

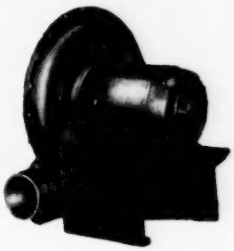
All welded for strength and high efficiency. With air or material wheels.

BULLETIN 3576

"RE" BLOWERS - EXHAUSTERS

For pressures up to 40" of water; 50 to 1600 cfm. Furnace blowing, line boosting.

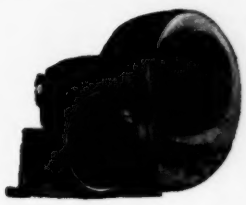
BULLETIN 3014



"E" BLOWERS - EXHAUSTERS

For low to medium pressures and volumes in draft, cleaning, line boosting.

BULLETIN 3014



BABY CONOIDAL FANS

Adjustable discharge, compact design, multi-blade rotors make these fans ideal for many small jobs.

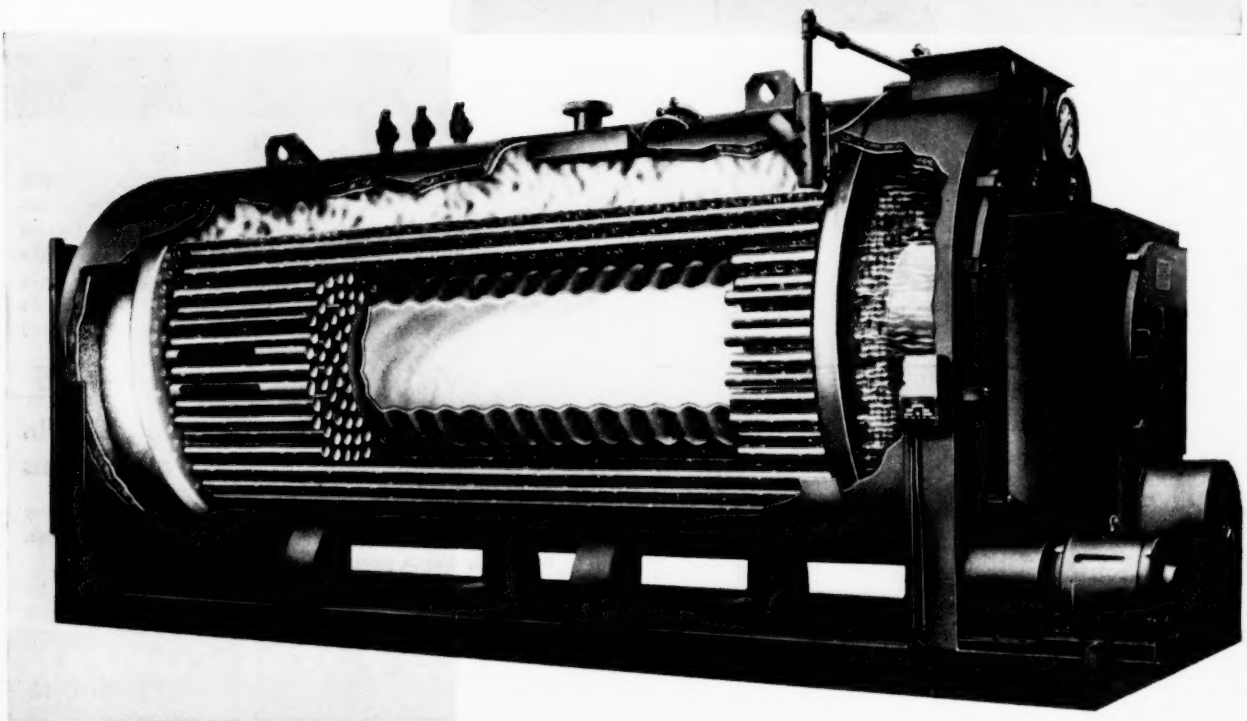
BULLETIN 3576

VOLUME FANS

Rugged blowers-exhausters with cast iron housings and dust-proof ball bearings for any job up to 10" s.p.

BULLETIN 3615

Do You Know About *Continental's* Two Pass Design?



...and do you know it takes one man less than 30 MINUTES to open a CONTINENTAL BOILER for cleaning or inspection...

WITH THE CONTINENTAL, you get a self-contained, automatic steam generator, built of best quality steel, and featuring advanced two pass design. The two pass design eliminates baffles that may break during operation and cause gases to short circuit and destroy efficiency.

WITH THE CONTINENTAL, 80% efficiency is guaranteed. Also, the use of forced draft and the elimination of baffles results in uniform distribution of heat through all tubes . . . insuring long life because all tubes do equal work.

WITH THE CONTINENTAL, you'll hold boiler down-time to a minimum because the clean-out and inspection doors at both ends are hinged and can be easily opened by one man in less than ½ hour.

WITH THE CONTINENTAL, fuel is fired directly into the firing tube which is completely surrounded by water. There is no dutch-oven and there is *no* refractory-lining in the water-backed furnace. This gives you maximum heat transfer, complete combustion, a high CO_2 and a low stack temperature. By eliminating refractory in the furnace, heat is transmitted to the boiler water without being stored and wasted in heating a refractory firebox . . . Steam with less than ½ of 1% moisture is assured in high pressure boilers, and less than 1% moisture in low pressure boilers.

WITH THE CONTINENTAL, you save on fuel (U. S. and foreign patents pending on exclusive firing method). The *oil burner* uses a pressure atomizing nozzle which is easy to service—has no cups or moving parts to wear out. The *gas burner*—rather than premixing—mixes fuel and air at the point of ignition, producing a uniform, highly radiant flame.

WITH THE CONTINENTAL, you get a boiler which, before shipment, is test fired and adjusted for maximum performance. No special stack or foundation required.

Continental Boilers, for high or low pressure, oil or gas fired—or combination thereof, range from 20 to 500 hp. Write for catalog 102.

CONTINENTAL is sold, installed and serviced by competent distributors throughout the U.S.

BOILER ENGINEERING AND SUPPLY COMPANY, INC.
1 Manavon Street • Phoenixville, Pa.
40 Years of Boiler Experience

Like in a pod...

. . . all diffuser types in the new Aerofuse Type 'P' Series are identical in appearance with beautifully styled matching facial contours and the same number of rings. This outstanding feature insures uniformity when more than one type – or more than one size – is installed in a conditioned area. Engineered to meet the most rigid specifications of efficient, satisfactory performance, each diffuser type in the new Aerofuse line is designed for a specific air delivery job. For an installation that is right, both in appearance and performance, specify Aerofuse at the vital point of air delivery.

Type PA
Adjustable Pattern Diffuser

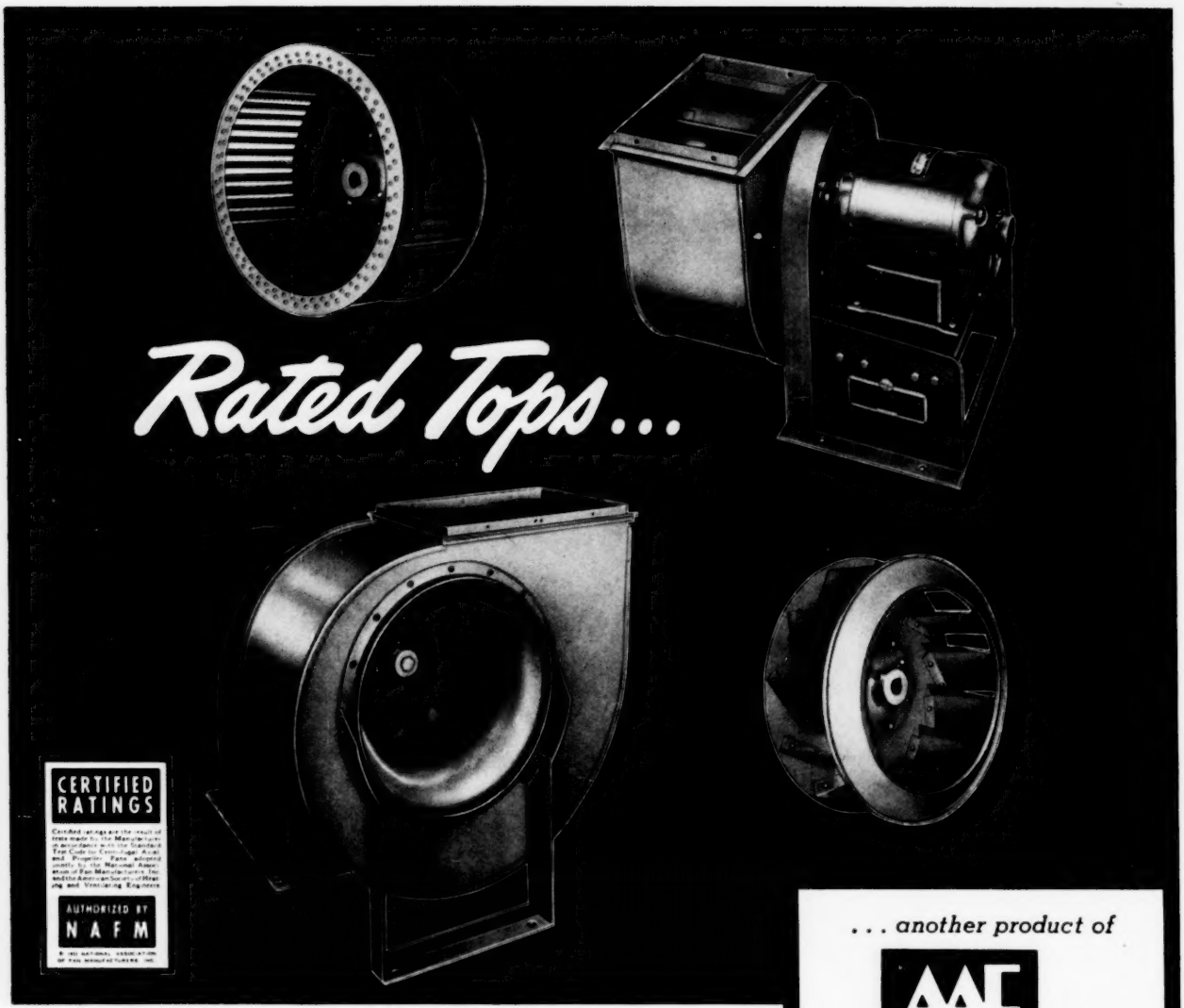
Type PS
Stepped-Down, Fixed Pattern Diffuser

Type PF
Flush, Fixed Pattern Diffuser

Type PR
Flush, Supply and Return Diffuser

Write for copy of Catalog No. 105 . . . complete information, selection charts, engineering data.

TUTTLE & BAILEY inc
NEW BRITAIN, CONNECTICUT



HERMAN NELSON UNIT BLOWERS

offer industry the most diversified selection of packaged Centrifugal Fans available

Herman Nelson offers you both Direct Drive and Belt Drive models—forwardly curved slow speed models or backwardly inclined non-overloading models. Each is designed for a specific job—a job it will *do better* because it's *built better!*

You can't buy a better unit blower and here's why. The wheel construction is rugged and highly efficient *and* the wheels are statically and dynamically balanced.

Herman Nelson offers completely self-contained units including motors. Every unit is compact in design and fits into small spaces. Smartly designed . . . Herman Nelson unit blowers are attractive in appearance as well as practical on the job.

There are 103 models to choose from with rated capacities ranging from 360 to 18,300 cfm. *Every* Herman Nelson Unit Blower carries the N.A.F.M. Certified Performance guarantee.

Specify Herman Nelson—and make certain you get the best Unit Blowers your money can buy. Write for complete information on any Herman Nelson Unit Blower to: HEATING AND VENTILATING PRODUCTS, DEPT. HV-7, AMERICAN AIR FILTER COMPANY, INC., LOUISVILLE 8, KENTUCKY.

. . . another product of

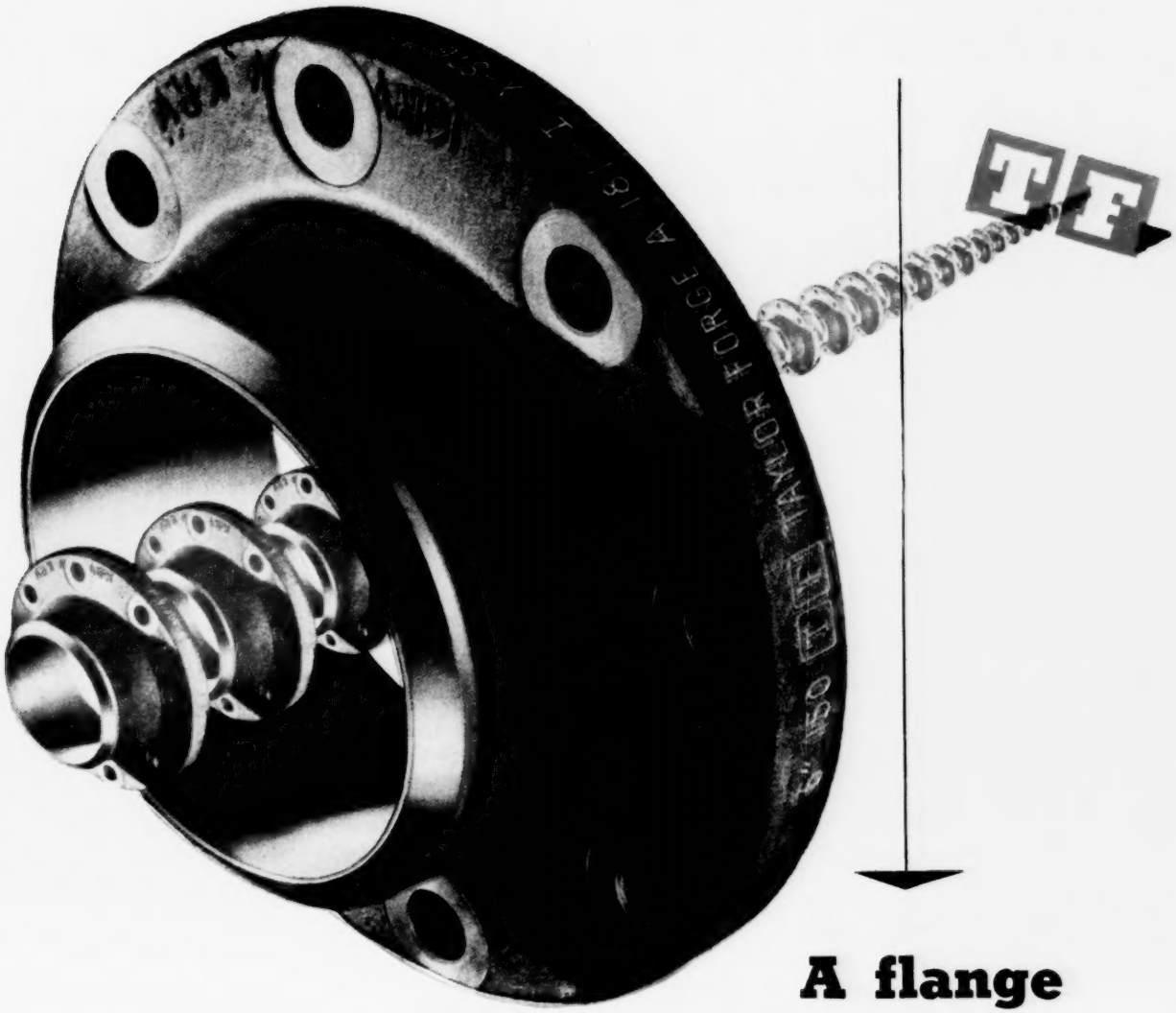
AAF

herman nelson

American Air Filter
COMPANY, INC

CHECK THESE HERMAN NELSON ADVANTAGES

- ✓ Rugged, highly efficient wheel construction
- ✓ Attractive, modern streamlined appearance
- ✓ Statically and dynamically balanced wheels
- ✓ Completely self-contained units including motors
- ✓ Compact design, easily fits small spaces
- ✓ N. A. F. M. certified performance
- ✓ 103 Models—capacities 360 to 18,300 cfm



A flange with a background...

You are looking at a flange with a history. Taylor Forge made the forged steel flange and in a sense the forged steel flange made Taylor Forge. It was Taylor Forge, back in 1905, who made the first forged steel flanges on a commercial scale . . . and it is Taylor Forge who has guided flange development across the past half century.

Through the first threaded flange form, the bolted Van Stone form, and the perfected welding neck form pictured here, Taylor Forge has undeniably contributed more to flange development than any other organization*.

Taylor Forge Welding Neck Flanges are a part of the WeldELL® line—the line that more than 20 years ago gave industry the first complete line of fittings for pipe welding. The organization that led development is still leading . . . in scope of types, sizes, weights, materials . . . in quality and downright value!

For up-to-the-minute facts see your Taylor Forge Distributor

TAYLOR FORGE

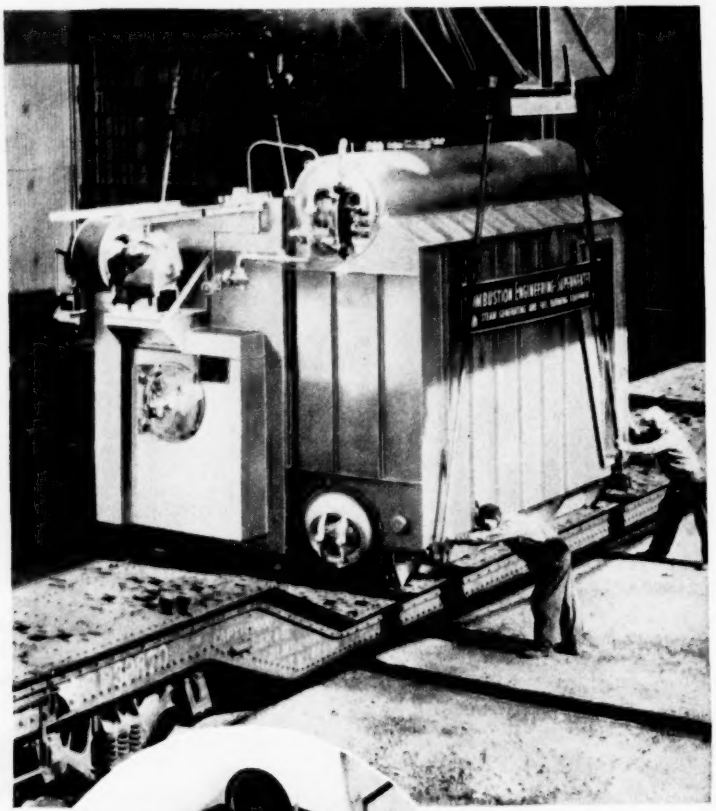
TAYLOR FORGE & PIPE WORKS, General Offices & Works: P.O. Box 485, Chicago 90

Plants at: Carnegie, Pa., Fontana, Calif., Gary, Ind., Hamilton, Ont., Canada

* When pressures rose from the old 150- and 300-pound standards to 400, 600 and finally 900 pounds, it was largely the exhaustive research of Taylor Forge that supplied the formulas for determining stresses in flanges for any given condition of loading. Among many examples: the Taylor-Waters formula, published in 1927, became and still is the basis of recognized practice for flanges in sizes through 24". Again, in 1938 Taylor Forge published the first edition of the now authoritative "Modern Flange Design" based on methods proposed by E. O. Waters, D. B. Rossheim, D. B. Wesstrom and F. S. G. Williams, Taylor Forge Manager of Engineering Standards. (ASME Trans., Apr. 1937)

Don't settle for just A Package Boiler

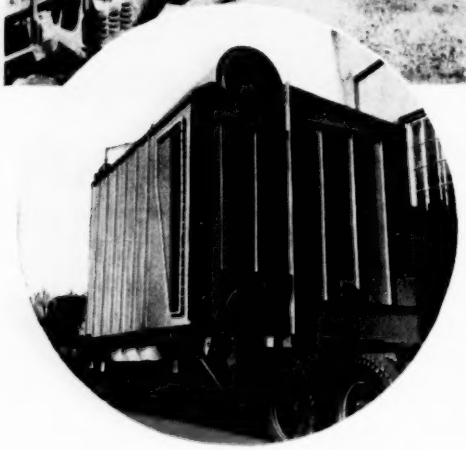
INVESTIGATE THE VP BOILER



...the Package Boiler with EXTRA features

If you're in the market for a Package Boiler, here's the problem you face. There are a number of water-tube package boilers being offered today. Most of them look pretty much alike. And, in some respects, they *are* alike.

But you're looking for the "best buy" in a package boiler. Therefore your interest lies in points of difference rather than points of similarity. The C-E Package Boiler, Type VP, offers all the better design features of its contemporaries *plus* the following extra features:



VP Boilers are available in capacities from 4,000 to 30,000 lb of steam per hr; pressures to 250 psi. Send for Bulletin VP-202.

1. Fully Water Cooled Furnace—More cooling area per cubic foot of furnace volume than any other boiler of the VP's size and type. In all but the three smallest sizes, the VP Boiler has water-cooled walls on *all six sides* of the furnace—including the burner wall.

2. Larger Lower Drum—The 30-in. diameter lower drum permits a simple, symmetrical tube arrangement . . . provides easy access for washing down or inspection . . . its greater water storage capacity facilitates the handling of fluctuating loads.

3. Centrifugal Fan—This more efficient type of fan operates at lower speed than other types and is quiet in operation. In fact, its average noise level is less than half that of typical high-speed fans used on most package boilers.

4. Simple Baffle Arrangement—Minimum changes in direction of gas flow—no baffle at all in convection bank of larger VP Boilers. This means lower draft loss . . . simplified soot blowing . . . absence of dead pockets, thus, maximum heat pick-up. In the intermediate sizes, a water-cooled baffle assures minimum maintenance.

B-6738

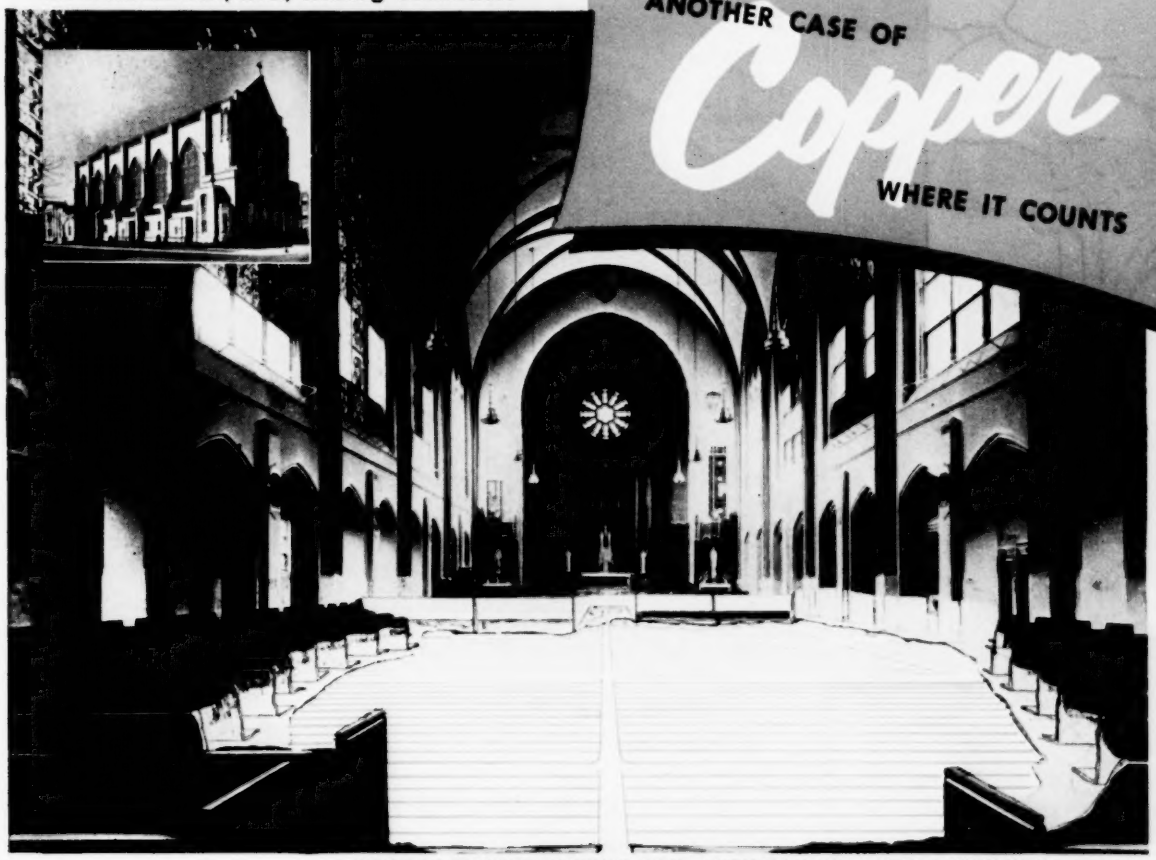
COMBUSTION ENGINEERING Inc.

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

ST. ANGELA CHURCH
Chicago, Illinois
M. J. HOLLERAN, INC., Heating Contractors

ANOTHER CASE OF *Copper* WHERE IT COUNTS



ISOMETRIC DRAWING FURNISHED BY M. J. HOLLERAN, INC., CHICAGO, ILLINOIS, Heating Contractor, shows how radiant heating panel was placed in concrete floor of Church. General Contractors: HENRY BROS. CO. Revere Distributor: H. W. BLYTHE CO. Mechanical Engineers: GEORGE W. HUBBARD & ASSOCIATES. Architects & Engineers: McCARTHY and SMITH, all of Chicago.

For heating churches there is nothing quite so satisfactory as a radiant panel heating system in a floor slab. Because, with this newest and most efficient method of heating, traditional church design may be maintained without sacrificing comfort. And for radiant panel heating there is nothing quite so satisfactory as copper water tube. For churches are built to last. And copper the "everlasting" metal has proved its enduring qualities through years of satisfactory service. Revere Copper Water Tube cannot rust, it's 60′ lengths in soft temper are easy to bend and require fewer fittings.

Regarding the St. Angela installation, McCarthy and Smith, Architects and Engineers wrote, "We are pleased to see results greater than anticipated in comfortable room conditions, low water temperature and ease and economy in operation." Commented the Rt. Rev. Msgr. D. F. Cunningham, Pastor, "The radiant panel heating worked like a charm. Our parishioners were comfortable at all times, even on the coldest days."

Now, with restrictions on the use of copper ended there isn't any reason why you can't use Revere Copper Water Tube for radiant panel heating, hot and cold water lines, underground service lines, processing lines, and waste stack and vent lines. See the Revere Distributor nearest you today. And, if you have technical problems, he will put you in touch with Revere's Technical Advisory Service.

REVERE

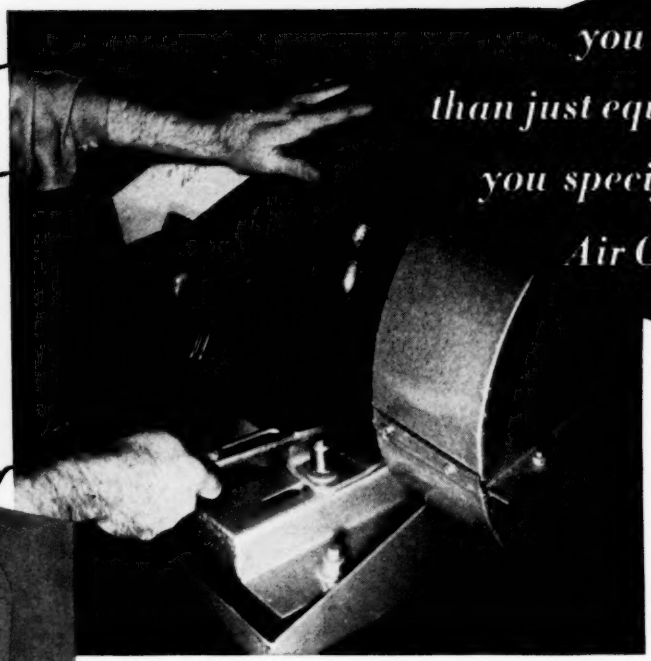
COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

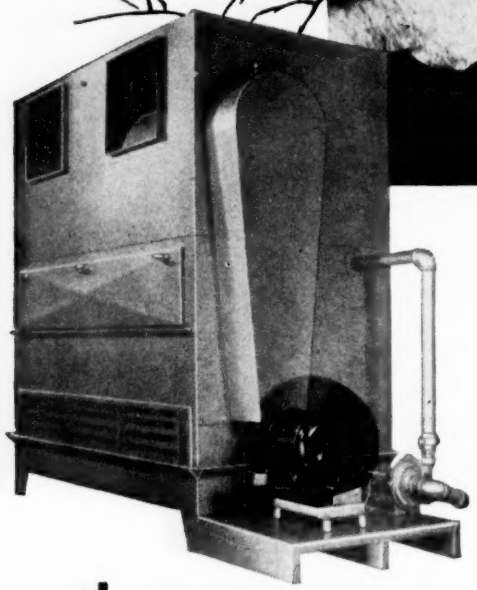
230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. • Sales Offices in Principal Cities, Distributors everywhere

SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS



you get MORE than just equipment when you specify **Marlo** *Air Conditioning*



for example...

Marlo mounts and tests motors at the factory

- ► *to save set-up time*
- ► *to assure longer, more efficient operation*

Into Marlo equipment goes special attention to those little extra details that transform a *good* piece of equipment into an *outstanding* piece of equipment.

Take motors, for example. Every Marlo motor is mounted on a pivot base easily movable in a horizontal or vertical direction. A simple adjustment establishes uniform tension on belts driving both the pump and the blower. This flexible mounting also permits easy belt replacement.

Every precaution is taken—before it leaves the factory—that the motor is

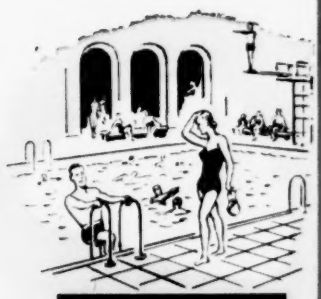
- ***Properly mounted***
- ***Checked for proper rotation***
- ***Lubricated throughout***

This concern for EXTRA details is the principal reason why IT PAYS TO SPECIFY MARLO EQUIPMENT

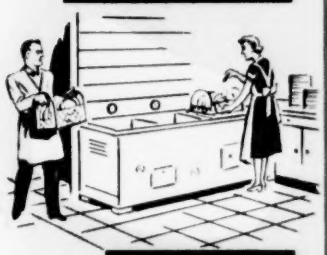
Marlo COIL COMPANY

Manufacturers of COOLING TOWERS • EVAPORATIVE CONDENSERS • INDUSTRIAL COOLERS • AIR CONDITIONING UNITS • MULTI-ZONE UNITS • BLAST HEATING & COOLING COILS

Saint Louis 10, Missouri



SWIMMING POOLS

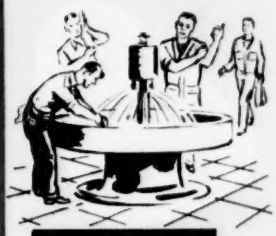


DISHWASHERS

SHOWERS

Fast, Dependable Action from ADSCO WATER HEATERS

SPACE HEATING

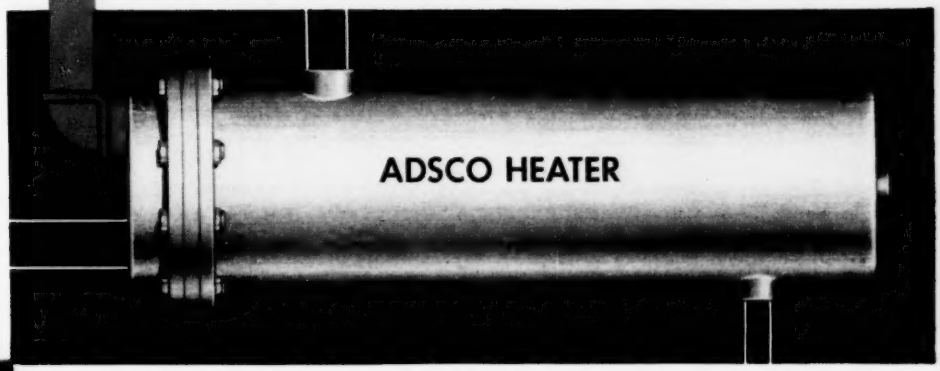


WASH ROOMS

LAUNDRIES

Hot water! Plenty of hot water! When and where you want it...and at low cost! ADSCO Water Heaters are dependable sources of hot water in any type of plant or building wherever there is a steam supply. Use ADSCO Water Heaters for space heating, for process hot water, or for such general service as showers, laundries, dishwashers, swimming pools...even for snow melting. Write today for Bulletin 35-77 on Convertors, or Bulletin 35-78 on Instantaneous Heaters.

Where storage heaters are needed, write for ADSCO Bulletin 35-75.



ADSCO ENGINEERED PRODUCTS

AMERICAN DISTRICT STEAM COMPANY, INC.

NORTH TONAWANDA, NEW YORK

Since 1877

FOR THE DISTRIBUTION AND UTILIZATION OF STEAM, LIQUIDS AND GASES

EXPANSION JOINTS | SEPARATORS | METERS | STEAM TRAPS | STORAGE HEATERS | STRAINERS

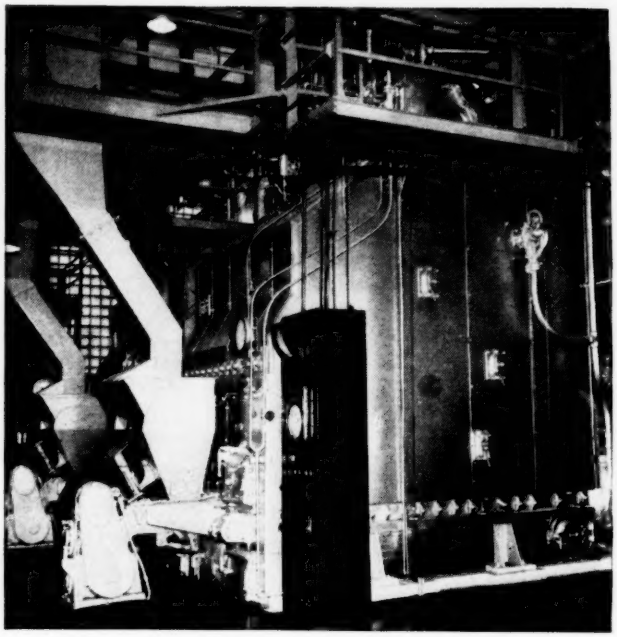
"WE SAVE $9,000 A YEAR—AND HEAT MORE SPACE—BY BURNING COAL THE MODERN WAY!

NEW COAL INSTALLATION SAVES US 31.9%—43¢—ON EVERY THOUSAND POUNDS OF STEAM!"

says Mr. Robert W. Paul,
Heating Engineer,
the University of Akron,
Akron, Ohio.

NO SMOKE CONDITION... NO DUST NUISANCE—

this plant is located in a residential neighborhood and operates well within the bounds of extremely tight smoke and dust regulations—thanks to burning and handling coal with up-to-date equipment!



This view shows Akron's two new stoker-fired boilers. The old equipment delivered a thousand pounds of steam at a cost of $1.35. Now Akron gets a thousand pounds of steam for only 92 cents, *cutting cost by nearly ⅓!* For about $26,000 a year, this new plant does the work that would have cost $35,000 with the old one.

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE

A Department of National Coal Association, Washington, D. C.

Planning to modernize? Building a new plant? In either case an up-to-date coal installation can save you lots of money!

Labor costs are cut to a minimum with modern coal- and ash-handling systems . . . modern combustion equipment gives more steam per dollar—10 to 40% more power from every ton of coal!

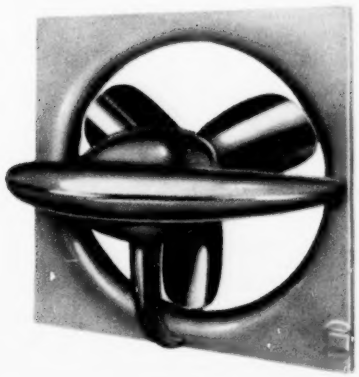
A consulting engineer can show you how these savings really mount up—and mount up fast—when you burn *bituminous* coal in a modern plant designed to meet your *specific* needs.

And coal's your best bet for the future, too. Of all fuels, coal alone has virtually unlimited reserves. And America's coal is mined by the most productive and efficient coal industry in the world. That's why coal offers greater price stability and more dependable supply than any other fuel!

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!

American Blower — a time-honored name in air handling



American Blower Model A Ventura Ventilating Fan. Capacities from 1000 cfm to 9700 cfm, free delivery.

Nothing, absolutely nothing, overcomes the objections to bad odors quite as well as removing them.

And American Blower Ventura Fans (see above) do this job quickly, quietly and at low cost.

Ventura Fans, Utility Sets, Heating, Cooling Coils, and complete Air Conditioning Units are but a part of American Blower's line of quality products.

You can profit from these products. Phone our nearest branch office for data.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation

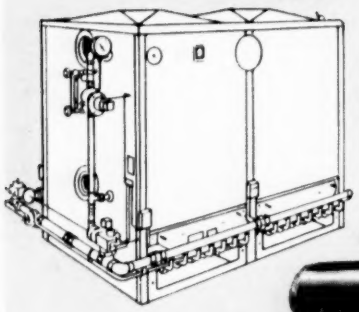
AMERICAN BLOWER

YOUR BEST BUY IN AIR HANDLING EQUIPMENT

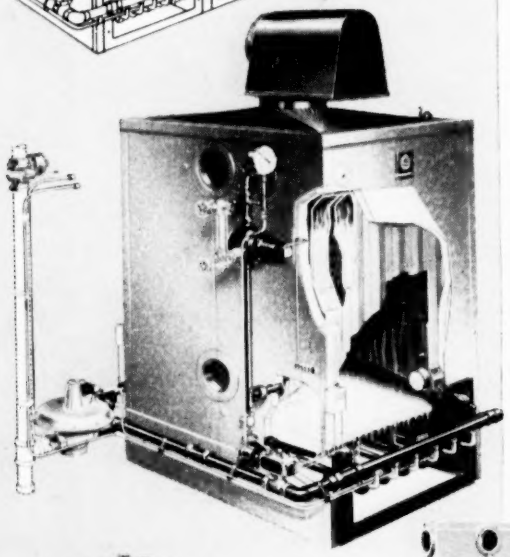
Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS

Quality-built, precision-engineered gas boilers for large homes and buildings



Available in two types and 25 SIZES



STANDARD BOILERS by AMERICAN-Standard

■ Made specifically for gas firing, Standard boilers embody the most modern engineering developments for efficient, completely automatic heating with lowest operating and maintenance cost.

Available in two types and twenty-five sizes, they cover practically every heating requirement for large homes, apartment buildings, hospitals, and various commercial and industrial installations. They can be used in batteries in larger buildings to provide an extremely flexible heat source through the operation of one or more units, thus giving added economy in mild weather, as well as perfect comfort in the coldest weather.

These construction details tell you why Standard boilers are better

PINTYPE SECTIONS of durable cast iron. Flue surfaces are studded with projections which absorb maximum heat from rising gases, transferring this heat to boiler water. Machine-ground surfaces require no cement where they're joined.

AUTOMATIC GAS VALVE is operated electrically by room thermostat. Regulates gas flow according to steam pressure or water temperature of boiler. Has sure-acting mechanical upper limit. Can be manually operated.

AUTOMATIC PILOT prevents flow of gas to main burners if pilot goes out. Special control for 100% safety shut-off for LP-gas and butane-air gas.

EFFICIENT BURNERS are precision-made for quiet, economical operation with each type of gas.

VENTURI MIXER TUBE induces proper velocity to gas and primary air, and obtains correct mixture of gas and air.

Sub-assembled and Easy to Install

Cast iron sections are precision-machined to facilitate quick and easy assembly. Individual sections may be conveniently carried through any ordinary doorway. To save further time and labor, controls, valves, and control piping are factory-assembled as far as practicable.

American Radiator & Standard Sanitary Corporation
P. O. Box 1226, Pittsburgh 30, Pa.

AMERICAN-Standard HEATING

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS

here's the *Automatic* answer for securing COMFORT and ECONOMY in schools...

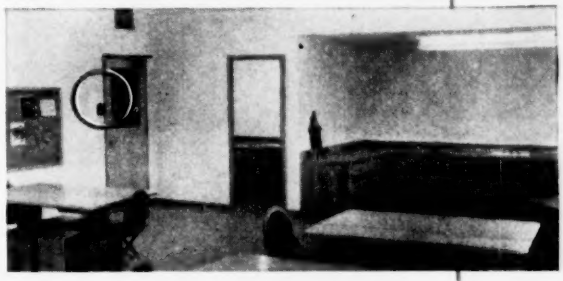
JOHNSON *DUAL* *temperature* CONTROL

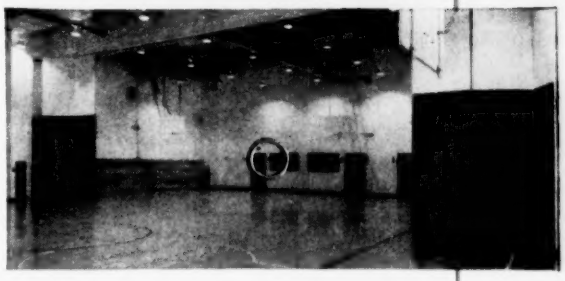
Endwell Junior High School, Endwell, New York. A. T. Lacey & Sons, architects; St. John, Platt & Carlson, mechanical engineers, both of Binghamton, N.Y.; Evans Plumbing & Heating Co., heating contractors, Endicott, N.Y.

Across the continent, well-planned schools, like Endwell Junior High School at Endwell, N.Y., are equipped with Johnson *Dual* Temperature Control, the pioneer two-temperature system. Johnson *Dual* is the answer to the problem of heating, to normal occupancy temperature, those rooms which are in use after regular school hours. And, in most school buildings today, some areas are in use during late afternoon and evening hours.

Heating the entire building, when it is only partly occupied, wastes fuel. The installation of separate heating mains for various sections of the building is expensive and inflexible. Johnson *Dual* Control allows each room or group of rooms to be heated as needed. At Endwell, *Dual* Thermostats in classrooms are interconnected in four groups while the auditorium and gymnasium sections each form a separate group. Thermostats, in a group where the rooms are not to be used, are set to operate at a reduced, non-occupancy temperature, from a switch on a central panel. If it is desired to occupy a single room, or two, merely pushing a button on the *Dual* Thermostat provides normal, occupancy temperature.

Johnson *Dual* Temperature Control is not limited to new buildings. It may be installed also in existing buildings, regardless of whether or not an ordinary system of automatic temperature regulation is already in use. Conversion to Johnson *Dual* is easy. Why not ask a Johnson engineer from a nearby branch office for recommendations, so that *your* buildings may have the advantage of money-saving, modern heating efficiency? JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.





At Endwell Junior High School, 67 Johnson Dual Thermostats provide "Proper Sequence" Control for Johnson Valves on convectors and, through Johnson Submaster Airstream Thermostats, for Johnson Valves and Damper Operators in unit ventilators.

T-335 Submaster Airstream Thermostat

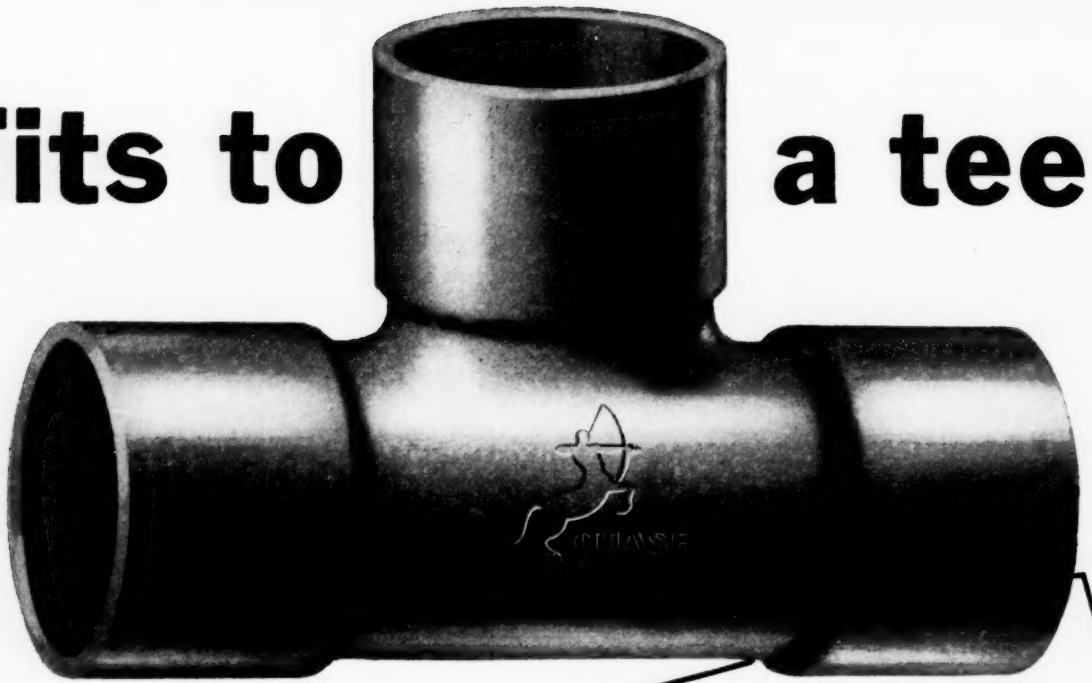
V-111 Unit Ventilator & Convector Valve

D-104 Unit Ventilator Damper Operator

JOHNSON *Automatic Temperature and Air Conditioning* **CONTROL**

MANUFACTURE • APPLICATION • INSTALLATION • SINCE 1885

Fits to a tee!



and stays Fit

even under 5,000 pounds per square inch pressure

It takes only minutes to make a Chase solder-joint that will stand up for years. In actual tests on assemblies of one-half inch Chase Copper Tube and Chase Solder-Joint Fittings, they have withstood over 3,400 pounds pull and 5,000 pounds per square inch water pressure.

Chase Flared Connections, too, are easy to make, tough to pull apart. Of course, all Chase fittings are corrosion-resistant, won't clog with rust. So for anything from drainage lines to radiant panel heating, be sure you specify Chase Copper Tube and Fittings. They assure better flow, longer life.

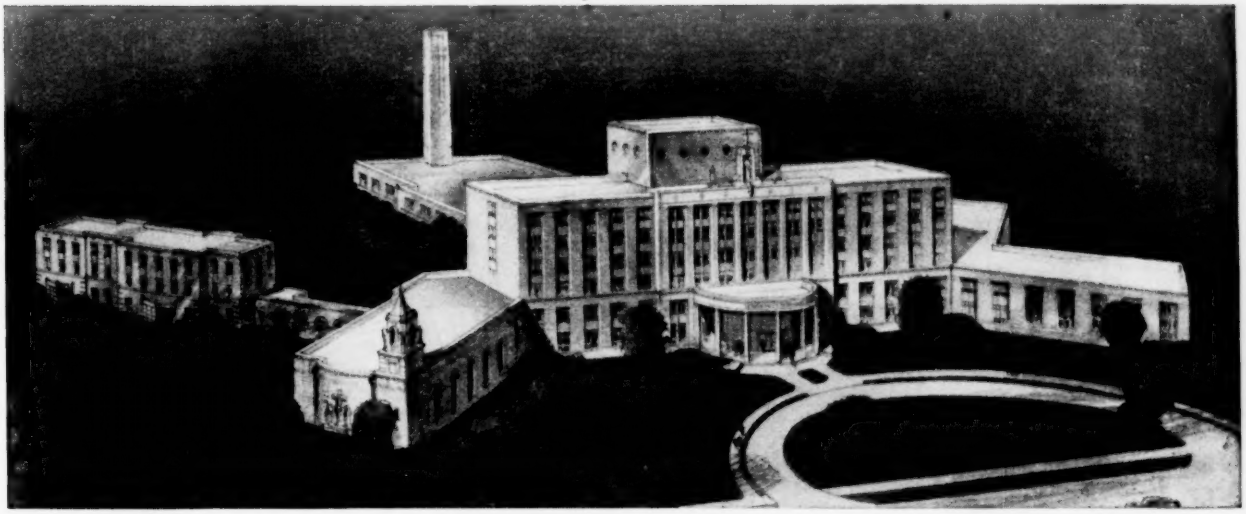
Chase ® BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

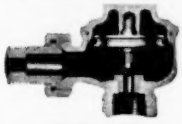
Albany†	Chicago	Denver†	Kansas City, Mo.	Newark	Pittsburgh	San Francisco
Atlanta	Cincinnati	Detroit	Los Angeles	New Orleans	Providence	Seattle
Baltimore	Cleveland	Houston	Milwaukee	New York	Rochester†	Waterbury
Boston	Dallas	Indianapolis	Minneapolis	Philadelphia	St. Louis	(†sales office only)

ILLINOIS ZONE CONTROL

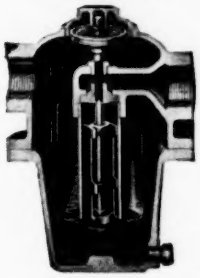


ST. ANTHONY'S MEMORIAL HOSPITAL, Effingham, Illinois
Architect: HENRY R. SLABY, A. I. A., Milwaukee, Wisconsin
Heating Contractor: PETERSON PLUMBING AND HEATING, Centralia, Ill.

Series 48 Radiator Valve



Series G Radiator Trap



Series G Float and Thermostatic Trap

An ILLINOIS High Vacuum Heating System perfectly controlled assures maximum fuel economy, comfort and convenience in this new hospital, convent, chapel group.

Steam is supplied from a high pressure boiler plant, with pressure reduced to two or three pounds for the heating, ventilating and air conditioning.

The hospital is heated with a four-zone ILLINOIS Type A Pneumatic Control System governed by electronic outdoor-indoor controllers. Operating rooms and maternity wards are heated by separate systems with individual control. The convent is equipped with a two-zone Cycling Flow Control System controlled by Type E-4 electric valves with two-stage thermostat and immersion stat.

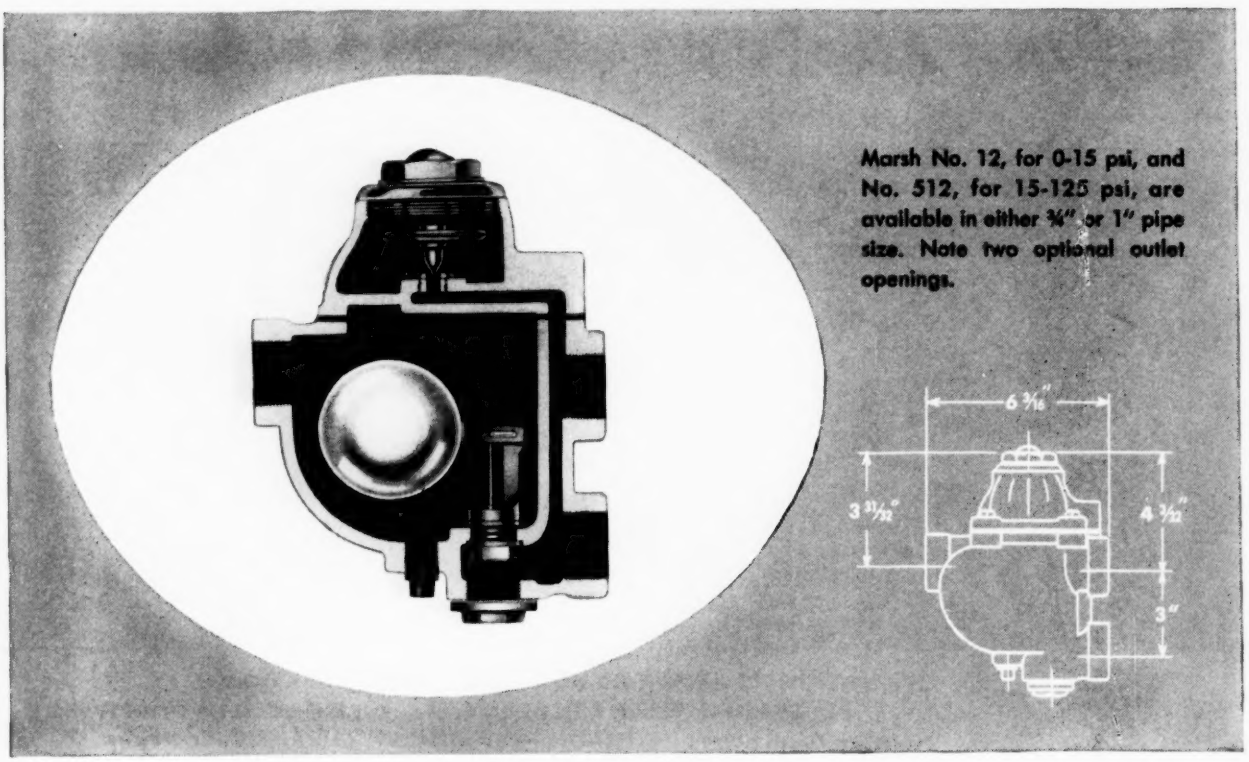
Other ILLINOIS Heating Systems include Type C Generation Control as well as the Standard Vacuum and Vapor Systems.

Write for Bulletins

ILLINOIS ENGINEERING COMPANY
INCORPORATED 1900
RACINE AVENUE AT 21ST STREET • CHICAGO

MARSH No. 12

Float and Thermostatic Trap


Marsh No. 12, for 0-15 psi, and No. 512, for 15-125 psi, are available in either ¾" or 1" pipe size. Note two optional outlet openings.
6 3/16"
3 31/32"
4 3/32"
3"

. . . The most dependable trap you can use

There are many jobs that only a float *and* thermostatic trap can handle properly . . . and in the Marsh No. 12 you have the most respected F & T trap ever developed.

Here is a trap that counts its users in thousands. Repeat orders are the rule because men who know have discovered that no other trap can quite duplicate its absolutely dependable, trouble-free performance in removing all air and condensate from steam mains, branches, risers, unit heaters, coils, and similar applications.

Two precision-built assemblies accomplish this. All condensation is discharged by the float-operated valve located at the low point in the trap body. All air is vented through the by-pass by the action of the thermostatic diaphragm, but this is one of those Marsh diaphragms that closes the valve immediately in the presence of steam. In fact the accuracy of response is the attribute that distinguishes the Marsh thermostatic element. It gets the air out and keeps the steam *in!* Another big feature is the straight through design which eliminates troublesome excess piping.

No. 12 is your F & T trap for those low pressure applications — up to 15 psi W.S.P. but its identical-in-operation companion, No. 512, covers the working pressure range of 15 to 125 psi. There is a Marsh trap for every low or medium pressure application.

Write for catalog 76-H covering Marsh heating specialties

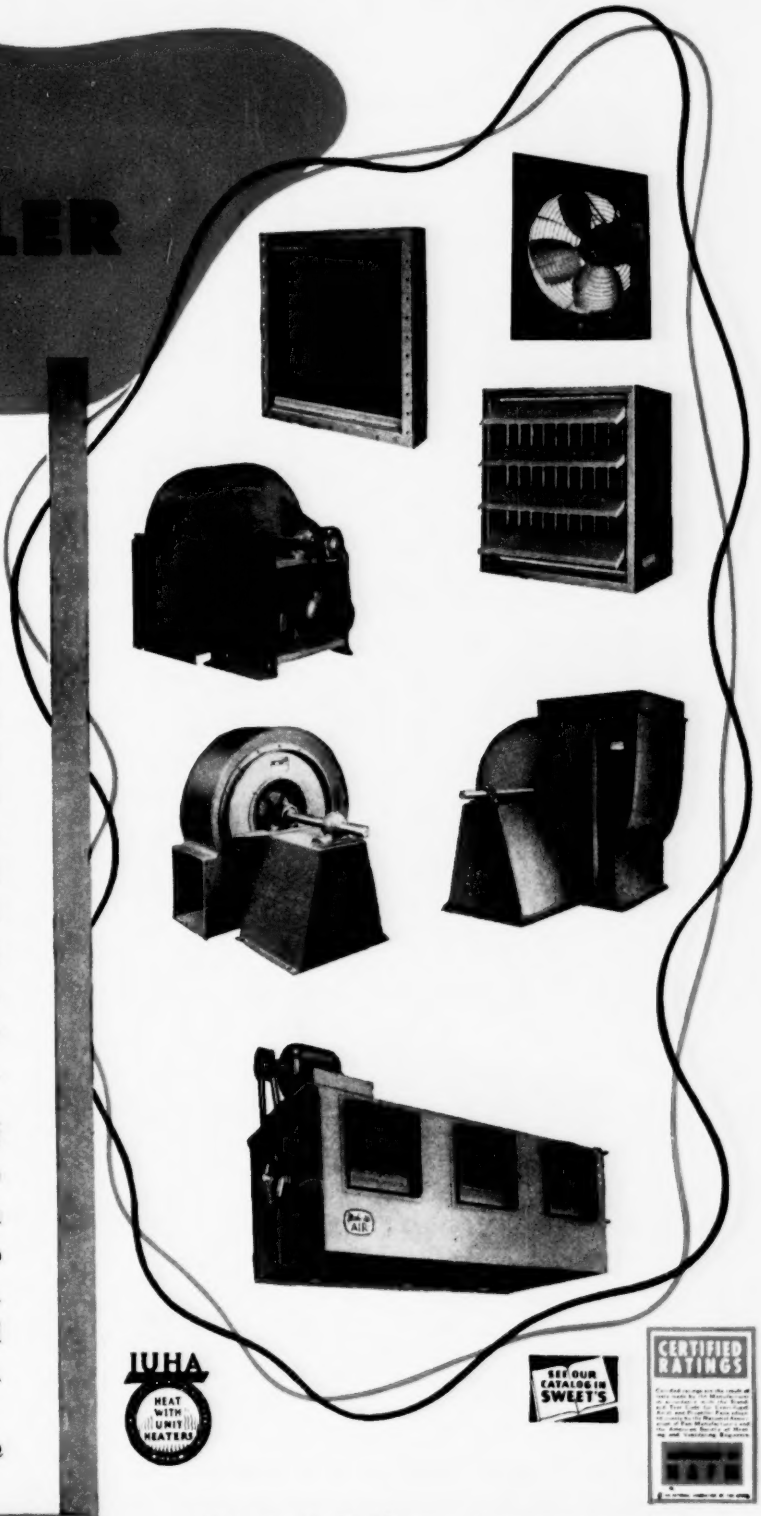
MARSH HEATING EQUIPMENT CO., *Sales Affiliate of Jas. P. Marsh Corporation*

Dept. U - Skokie, Illinois

Manufacturers of gauges, thermostatic regulating valves, Solenoid valves, heating specialties

MARSH *Heating Specialties* **SINCE 1865**

nyb PROPELLER FANS



Propeller type ventilating fans deliver large volumes of air at low resistance and low current consumption. All wheels are machine balanced for smooth, vibrationless operation. Made in 2 types and 7 basic sizes to cover a wide range of industrial applications. Pressed steel panels provide rigid support and simplify installation. Totally enclosed motors mounted in heavy welded wire safety guard. Wheel diameters from 12 inch to 48 inch. Direct or belted drive. Capacities from 675 cfm to 23,500 cfm.

Penthouses for roof installation of **nyb** Propeller Fans can be furnished in 7 sizes. Louvers open and close automatically to protect fan against the weather. Separate louvers for wall mounting also available.

Write for Bulletins

IUHA HEAT WITH UNIT HEATERS

SEE OUR CATALOG IN SWEET'S

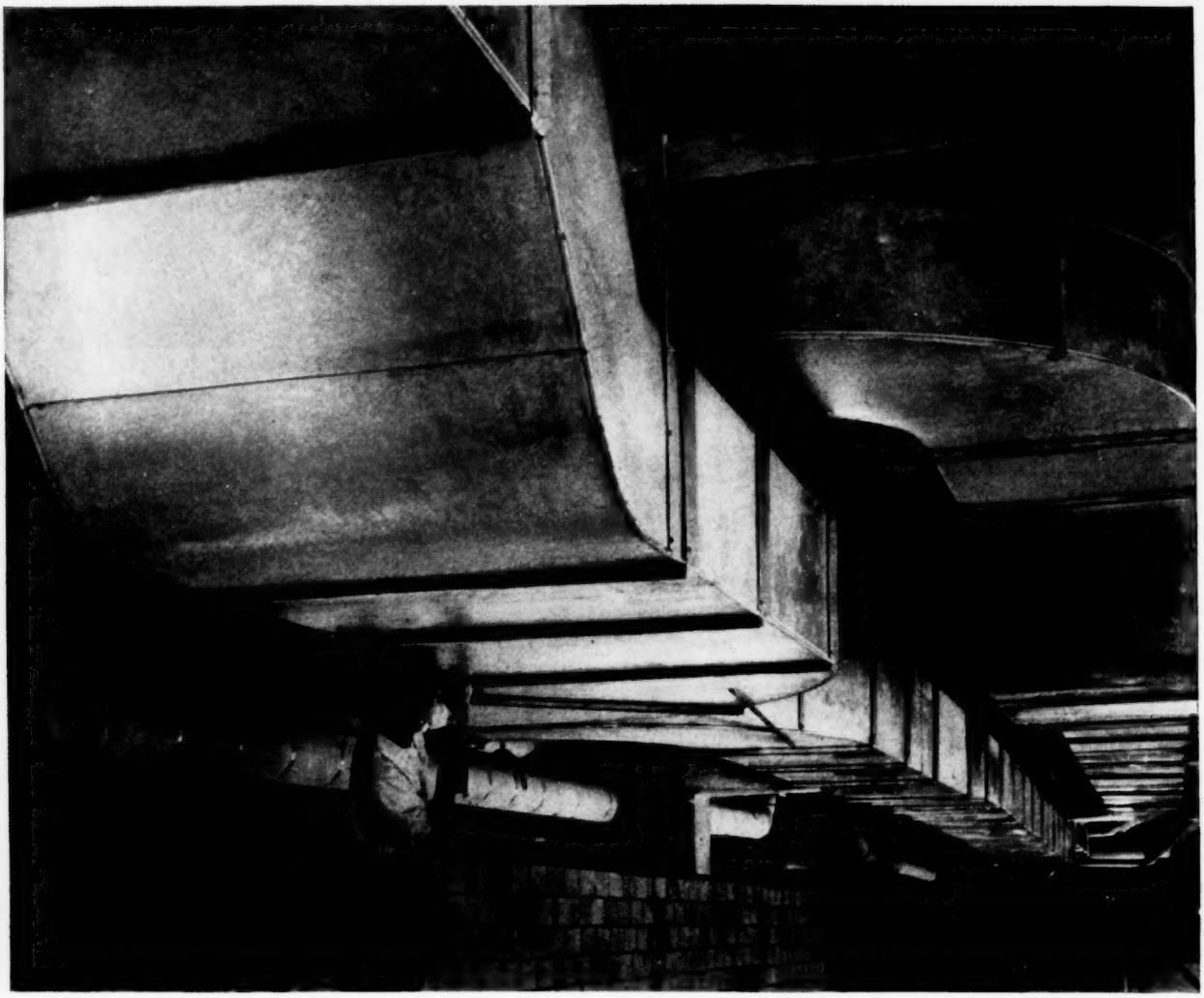
CERTIFIED RATINGS

All New York Blower Company products are laboratory tested, accurately rated and fully guaranteed in strict accordance with Standard Test Codes.

THE NEW YORK BLOWER COMPANY

SALES OFFICES • 3165 SOUTH SHIELDS AVENUE • CHICAGO 16

FACTORY, LAPORTE, INDIANA



For Strength and Stiffness Nothing Beats Galvanized Steel

Look at each of the materials commonly used for ductwork, and you realize the strongest and stiffest of them all is steel.

That's why a galvanized steel sheet has less tendency to buckle or kink in handling. Less bracing is needed. Longer unsupported sections can be used. And there is better resistance to damage from rough handling.

Bethlehem galvanized steel sheets are made from strong, durable steel, either plain or copper-bearing. Tight, uniform zinc coating guards them against corrosion. They are easy to cut, form, seam and solder. And they give a bright, clean look to any kind of sheet-metal job.

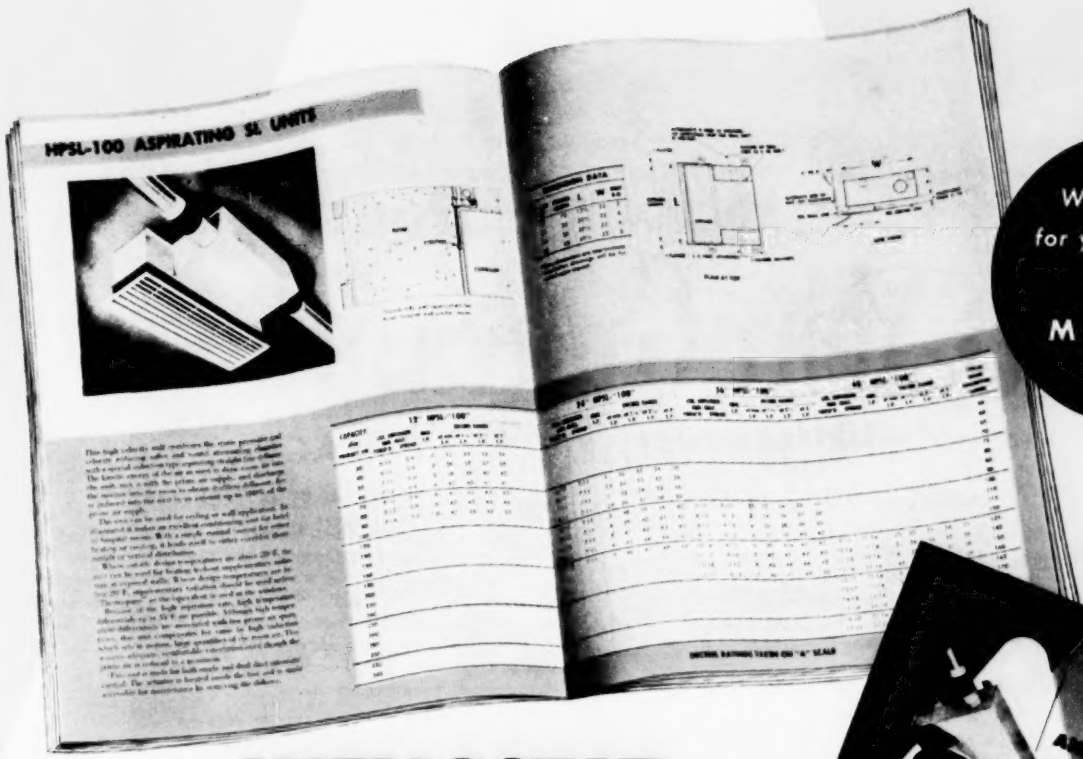
Bethlehem GALVANIZED Steel Sheets

★ BETHLEHEM STEEL ★

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

Here is useful engineering **Data** *on high velocity....*



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ANEMOSTAT CORPORATION OF AMERICA

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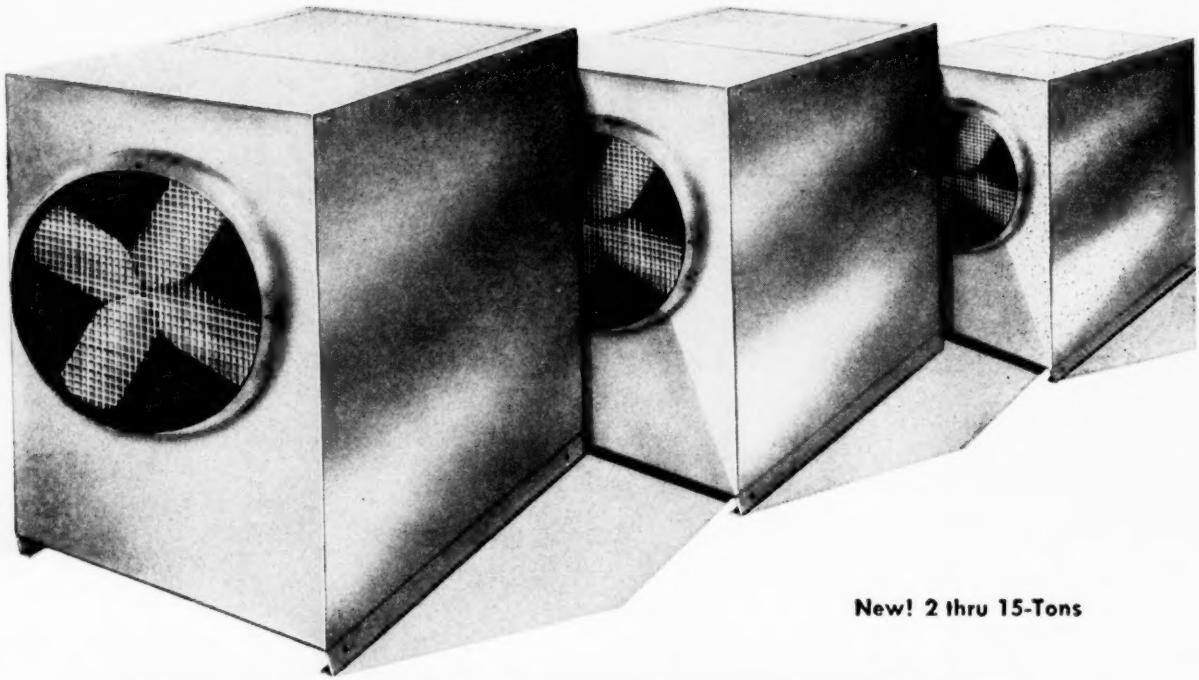
REPRESENTATIVES IN PRINCIPAL CITIES

"No Air Conditioning System Is Better Than Its Air Distribution"

RESIDENTIAL COOLING TOWERS



New! 2 thru 15-Tons

ONLY HALSTEAD & MITCHELL OFFERS THE

20-Year Guarantee!

ON THE WETTED DECK SURFACE

PRICED FOR THE HOME MARKET

Price-wise these Halstead & Mitchell Residential Cooling Towers throw open huge segments of the home and small building market to air-conditioning. Here is the development for which the industry has been waiting. Check prices today!

NOW REQUIRED IN MANY AREAS

Residential Cooling Towers recirculate precious water . . . meet requirements of municipalities which prohibit wasting cooling water to sewers. And low cost H&M units take residential air conditioning to the suburbs and rural area . . . recirculate from a cistern if need be!

MADE FOR REAL OPERATING ECONOMY

Economical, lastworthy . . . low operating cost matches low initial cost. Efficient gravity-type distributing pan eliminates windage loss since atomizing by spray nozzle is unnecessary. Low pump head pressure is another bonus of gravity distribution. And maintenance is a snap!

FAMOUS HALSTEAD & MITCHELL QUALITY

Here's *all* the quality for which Halstead & Mitchell Cooling Towers are world famous — including the 20-year Guarantee on the wetted deck surface of pressure-treated creosoted wood, against attack by rotting or fungi growth. Stainless steel fans and shafts, plus individual cabinet coatings of Vinsynite, Vinyl Zinc and chlorinated rubber add important years of life. The complete assembly is with Everdur bolts . . . disassembly is easy even after years of service.

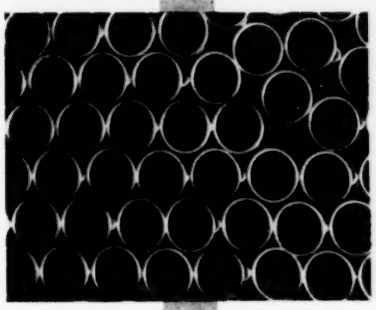
AT LEADING WHOLESALERS EVERYWHERE

Write for descriptive bulletin from Halstead & Mitchell, one of the world's largest manufacturers of water-cooled Cleanable Condensers, and Cooling Towers up through 100-tons.

Halstead & Mitchell

OFFICES: BESSEMER BUILDING • PITTSBURGH 22, PA.

What Proves the Worth of a Boiler Tube?



Claims of dependability . . . of consistently uniform wall thickness, diameter, and physical properties . . . of freedom from scale, slivers, pitting, and other defects inside and outside a tube, are common—*and true*—for all quality boiler tubes regardless of the mill that supplies them. They are true because *all boiler tubes must conform to the same specifications for the same jobs.* Side-by-side they're "look-alikes," yet there is a difference . . . a difference that only *time* can prove under the grueling conditions of heat, pressure, corrosion, and oxidation found inside a modern boiler. B&W boiler tubes have met this test of time in boilers serving the widest variety of applications . . . utilities, industries, government institutions, hospitals, office buildings, apartment houses . . . wherever fine boilers are operating efficiently over extended periods.

Say B&W before you say WELDED BOILER TUBES—for Service-Proved Dependability.

For three-quarters of a century, B&W has been directly concerned with developing and applying boiler tubes for lowest pressures up to those approaching 3000 psi. The application of this extensive knowledge and experience results naturally in the production of finer boiler tubes.

B&W dependability is proved by time and endorsed by hundreds of customers who keep coming back for more . . .

B&W WELDED BOILER TUBES.

B&W SEAMLESS and WELDED TUBES

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION
Beaver Falls, Pa.—Seamless Tubing; Welded Stainless Steel Tubing
Alliance, Ohio—Welded Carbon Steel Tubing

TA-1742 (A)

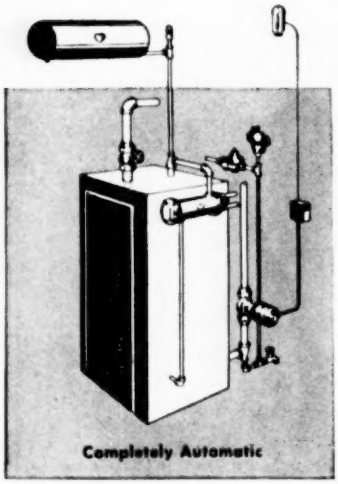
Less than
1/5 of 1° variation in
room temperature

More Livable Space with
Modern Radiant Heat

THRUSH *Radiant HOT WATER HEAT

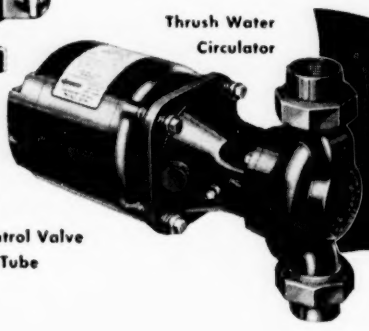
BUILDS FRIENDS FOR YOU...

WHEN YOU SELL and install the most modern and economical heating system . . . Thrush Radiant Hot Water . . . you make friends and boosters for your business. Home owners appreciate the level, unvarying temperature it provides. There's no fluctuation . . . no overheating, and radiant heat is constant . . . regardless of weather changes. Forced Circulation means positive delivery of heat to every heating unit . . . and there's plenty of hot water for kitchen, laundry or bath the whole year through. *Ask your wholesaler about Thrush Systems today or write Dept. D-7.*



Completely Automatic

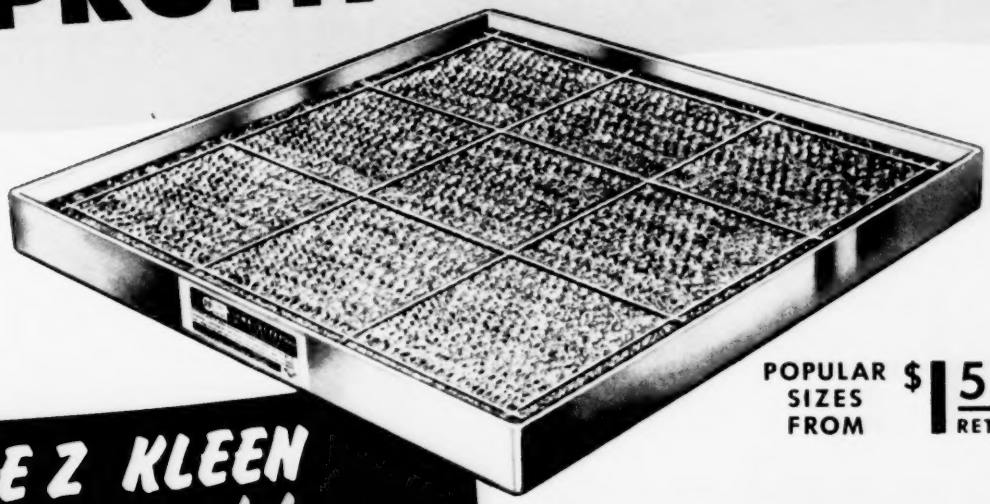
Flow Control Valve
with Air Tube



Thrush Water
Circulator

H. A. THRUSH
& COMPANY
PERU • INDIANA

Get this Fast Selling PROFIT BUILDER



POPULAR SIZES FROM $1.55 RETAIL

E Z KLEEN *Washable* AIR FILTER

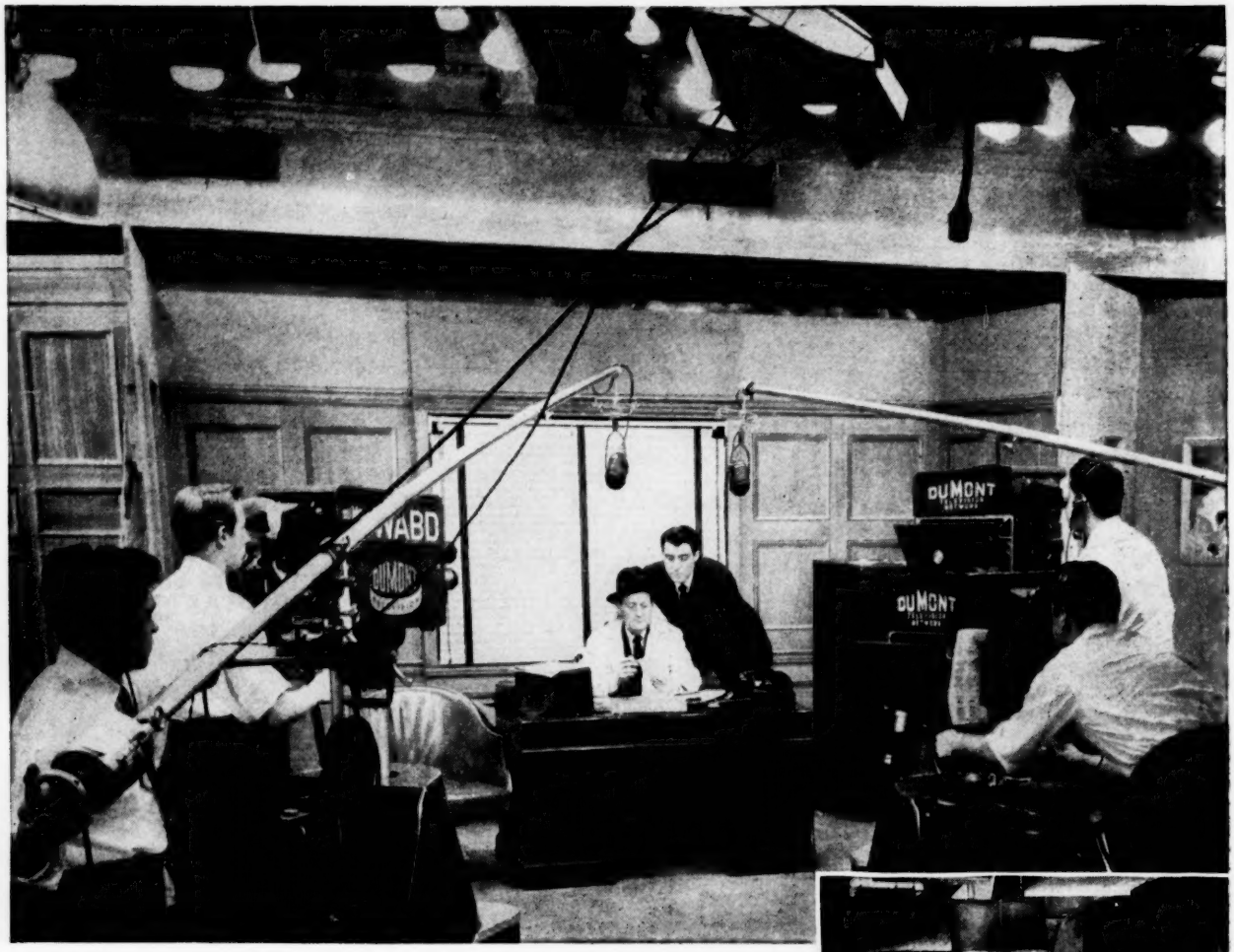
...for all forced air furnaces and air conditioners

Now Pre-sold by National Consumer Advertising

Here's an item that fits into every dealer's picture . . . a washable air filter for forced air furnaces and air conditioners! You get extra profits by selling them to homemakers who wish to service their own filters . . . or if you prefer, you can establish a high-profit filter service business. Order now from your jobber. Displays, window streamers, ad mats, stuffers and other sales helps are available.

RP . . . PRODUCTS OF RESEARCH

RESEARCH PRODUCTS CORPORATION
Dept. 28, Madison 10, Wisconsin



Putting Air to work for DuMont: Air conditioning must absorb the heat of powerful overhead lights. But it must be *quiet*.

ON THE AIR

EQUIPMENT NOISE IS NOT IN THE SCRIPT

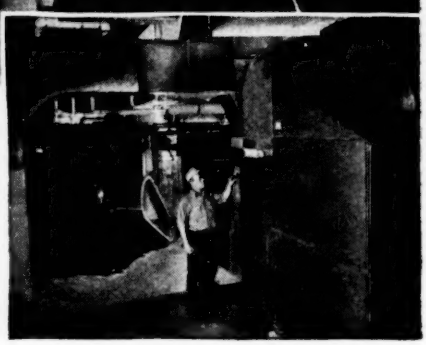
Television won't tolerate noisy equipment. Super-sensitive mikes pick up and magnify every whisper. They have to because they must keep out of camera range—often 5 to 10 feet from the actor's lips. Equipment which raises the general sound level cannot be used.

Yet these closed-in studios with their high heat loads must be air conditioned. That's why silent Westinghouse fans and air handling units were chosen for the DuMont Network's New York Tele-Centre. *Every minute* 160,000 cubic feet of conditioned air is supplied noiselessly.

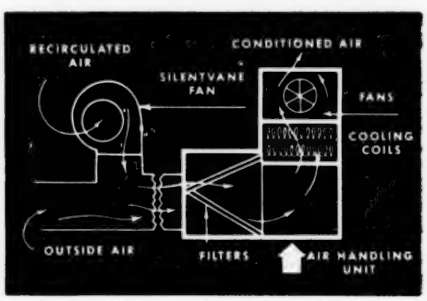
If you are interested in quietness—or efficiency, or dependability—when it comes to *putting air to work*, come to Westinghouse. A complete line of air handling, air conditioning and air cleaning products means undivided responsibility. Ask us for General Catalog 600. Call your local office, or write: Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.

WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE...IF IT'S **Westinghouse**



Here's the equipment which conditions the air. At left, one of many silent Westinghouse fans pulls heat-laden air from the station. At right, one of the "packaged" Westinghouse air handling units filters the air, cools, dehumidifies, and returns it. These factory-assembled units give quiet, dependable performance—with a single manufacturer's warranty.

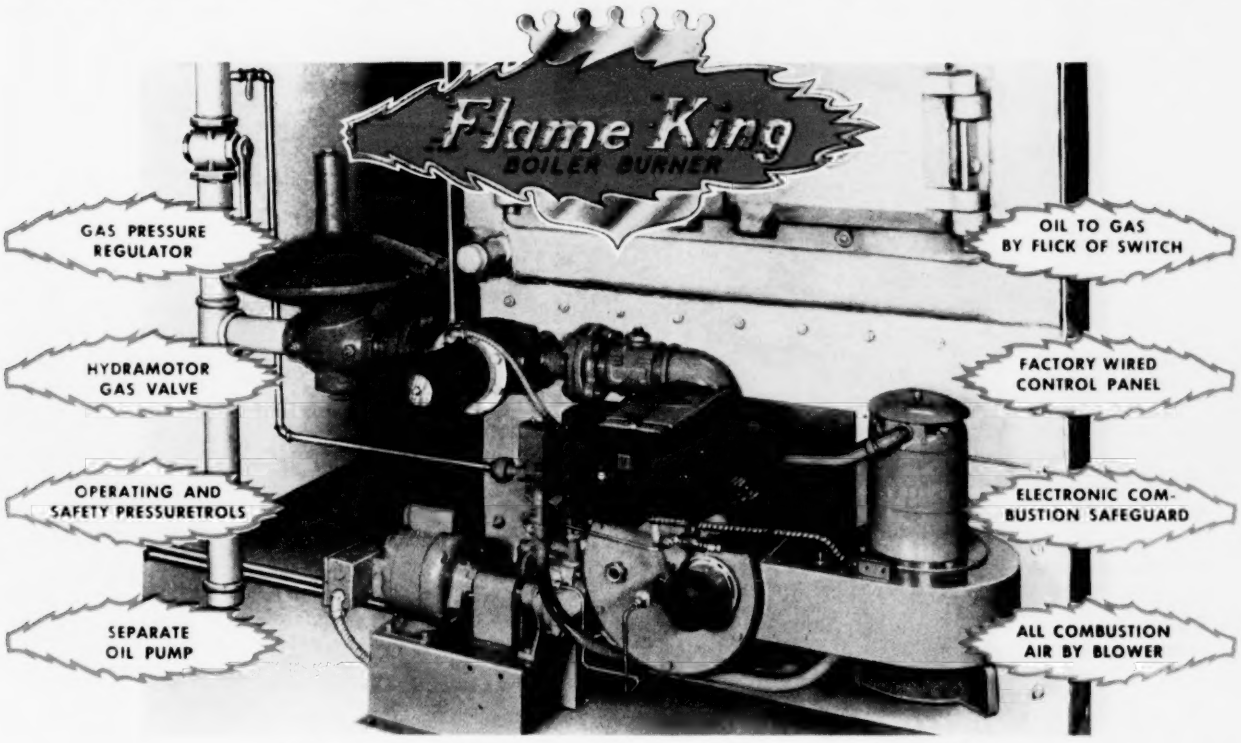


Ultimate Performance

30 to 1000 horsepower

NORTH AMERICAN

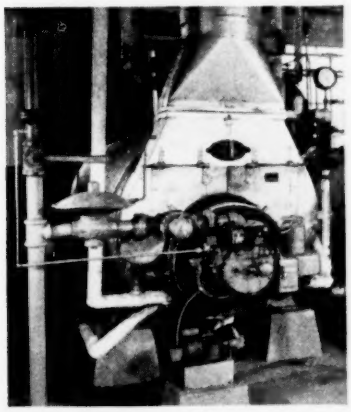
GAS, OIL or DUAL-FUEL



116 Dual-Fuel Burner illustrated available in models ranging from 30 to 83 HP

FLAME KINGS are available as gas or oil burners (that may be field converted to dual-fuel) or dual-fuel burners that will burn either fuel at the flip of a switch. Design, backed by 30 years of combustion experiences and proven by years of installations in all types of boilers, assures maximum efficiency on either fuel.

Factory packaging of FM approved electronic combustion safeguard systems provides for easy installations! Plug-in electrical components allow minimum maintenance! Burner efficiency is not dependent upon stack draft since a blower supplies 100% of the air for combustion! Blast-type gas pilot provides for positive and safe ignition!



FLAME KING on Scotch Marine Boiler

Natural gas (only 3" wc pressure necessary), mixed low pressure gases, or No. 1, 2, or 3 fuel oil burned at peak combustion efficiencies! Separate oil pump is operated only when burner is burning oil!

If you are interested in modern, efficient burners at reasonable prices, call your nearest FLAME KING distributor, or send in the coupon below.

• • •

Some areas still available for distributing representatives.

CUT OUT AND PASTE ON YOUR LETTERHEAD

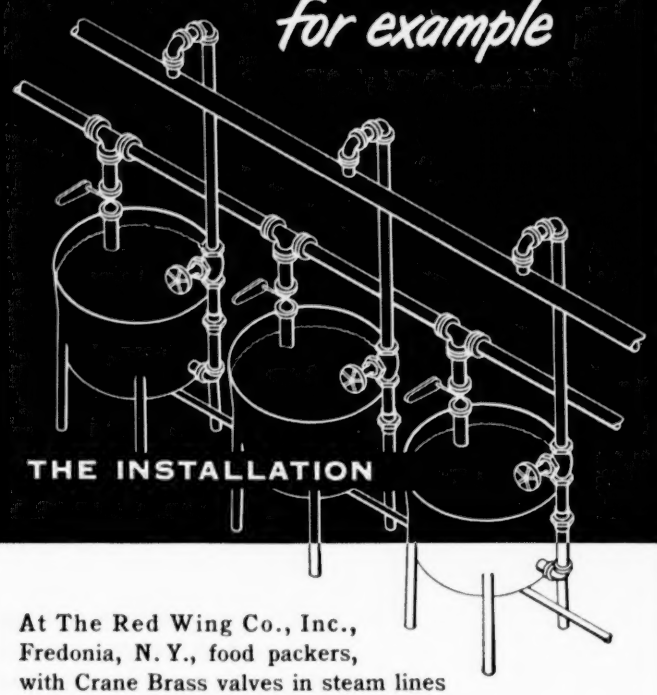
We want more information

NAME_____

TITLE_____

Mail today to
The NORTH AMERICAN Mfg. Co.
Cleveland 5, Ohio

How Better Quality Valves Pay Off ...on Steam Throttling, for example



THE INSTALLATION

At The Red Wing Co., Inc., Fredonia, N. Y., food packers, with Crane Brass valves in steam lines to juice heaters and cooking kettles.

VALVE SERVICE RATINGS

SUITABILITY: None better for throttling

MAINTENANCE COST: No expense here

SERVICE LIFE: No sign of wearing out after 4 years

OPERATING RESULTS: Precise control of steam to cookers

PRICE: Bigger value than any other valve used

AVAILABILITY: Regular Crane Catalog Item - No. 212P

THE CASE HISTORY

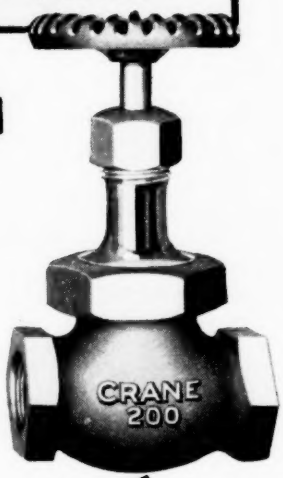
At least once a week there was valve trouble in the cooking room. Leaky valves . . . disc and seat cut out . . . steam to kettles out of control.

New valves made little difference; none could stand the severe steam throttling. Not until Crane plug-type disc valves were installed.

Immediately the valve trouble stopped as did the cooking interruptions. Not even the plant operator believed it possible. In use now more than 4 years with no maintenance cost, the Crane No. 212P valves are still in like-new condition. They show no erosion, no leakage; and they operate freely.

THE VALVE

Designed expressly for severe throttling service, these Crane brass valves have plug type disc and seat of Crane Nitri-Hard stainless steel. Seating surfaces are practically impregnable to damage by cutting, erosion, etc. Disc taper permits close flow regulation. For any kind of throttling look into these valves for 150, 200, and 300-pound steam services. Your Crane Catalog or your Crane Representative will give you all facts.



THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

SAVE PURCHASING MANHOURS...

USE Your Distributor

WHEN you put your TUBE TURNS' Distributor on your buying team, you can consolidate many orders into one . . . saving you valuable time. Your TUBE TURNS' Distributor assumes the responsibility of dealing with many manufacturers' salesmen and expediting and following through your orders.

TUBE TURNS' Distributors and TUBE TURNS, INC. are a service-minded team. Call your nearby TUBE TURNS' Distributor to save your purchasing time, to simplify your bookkeeping, and to obtain leading brands . . . brands that have got to be good.

The Leading Manufacturer of Welding Fittings and Flanges

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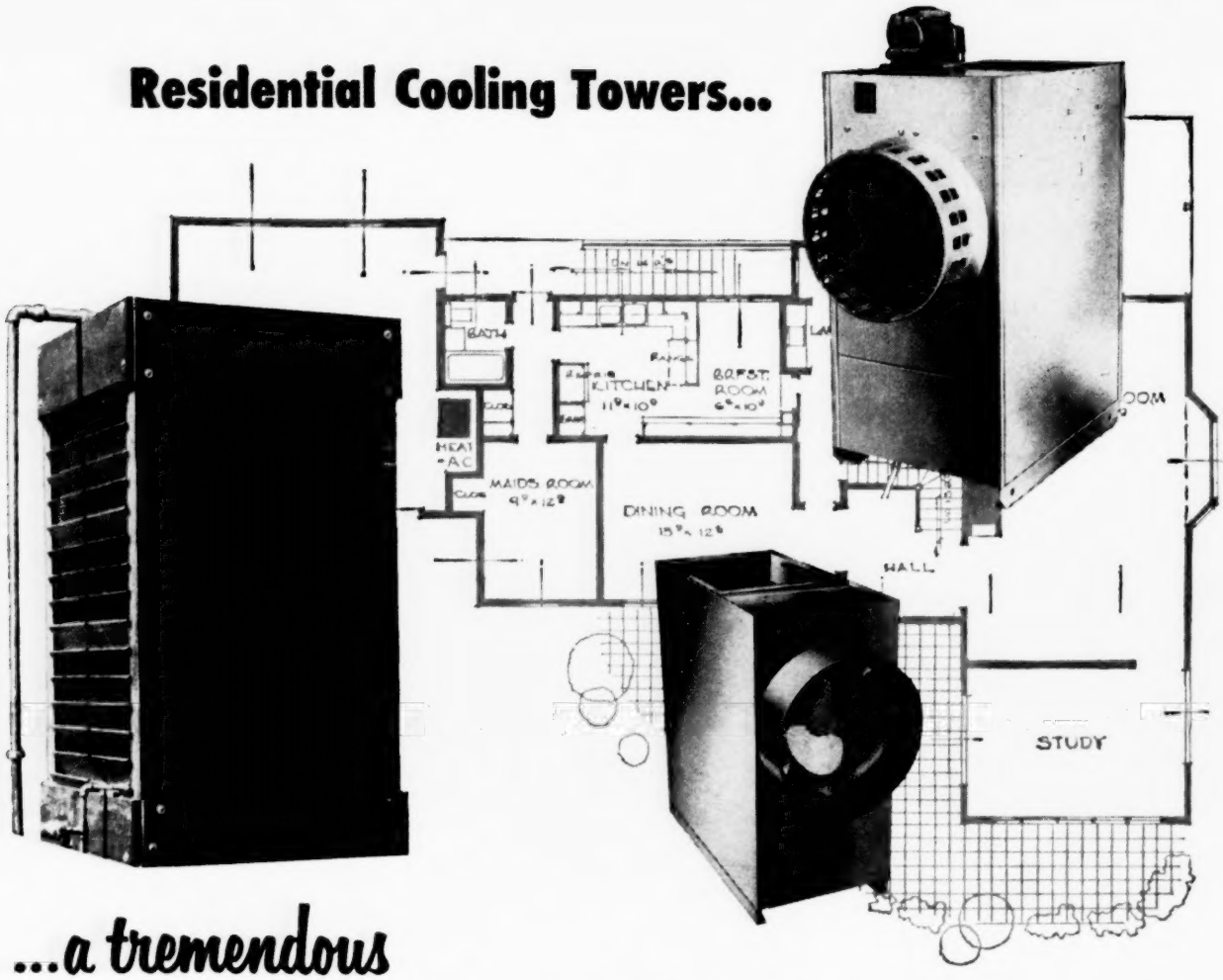
DISTRICT OFFICES: New York · Philadelphia · Pittsburgh · Chicago · Houston · Tulsa · San Francisco · Los Angeles · Denver · Atlanta

Subsidiaries: TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO • PENNSYLVANIA FORGE CORPORATION, PHILADELPHIA, PA.

Residential Cooling Towers...



...a tremendous new market—

and it's a

MARLEY MARKET!

The 1953 line of Marley cooling towers offers *everything* you need to cash in on the tremendous market for residential cooling towers. It's the only *complete* small-tower line—designed, manufactured, tested, guaranteed, and "presold" by the world's leading manufacturer of water cooling equipment.

If the job calls for an Aquatower,* Marley has them—a complete line of sizes and models for indoor or outdoor services from 2 to 60 tons. If you need natural draft towers, Marley has them—in a wide range of sizes and styles . . . built of only heart quality redwood . . . equipped with patented Marley non-clog spray nozzles. And whatever your requirements, you can count on over-the-counter delivery from Marley stocks in 30 cities.

To make sure that you get your share of "the Marley market," get in touch with your nearest Marley representative for expert assistance in tower selection and information on the complete Marley line.

MARLEY

*Registered trade mark

The Marley Company

KANSAS CITY, MISSOURI

HYDRALINE BASIC UNIT

BORG-WARNER *announces*

Hydraline

A NEW CONCEPT IN YEAR 'ROUND RECESSED ROOM AIR CONDITIONING WITH CENTRAL FORCED WATER SYSTEMS

Developed for the master plumber by Borg-Warner engineering skill, the Hydraline Basic Air Conditioning Unit is a compact, forced-air room air conditioner.

Fully recessed in walls or under floors, Hydraline Basic Units are designed for use with central forced water systems to combine individually room controlled winter heating and summer cooling *at the lowest cost in history!*

Individual Room Control, Perfect Balance for:

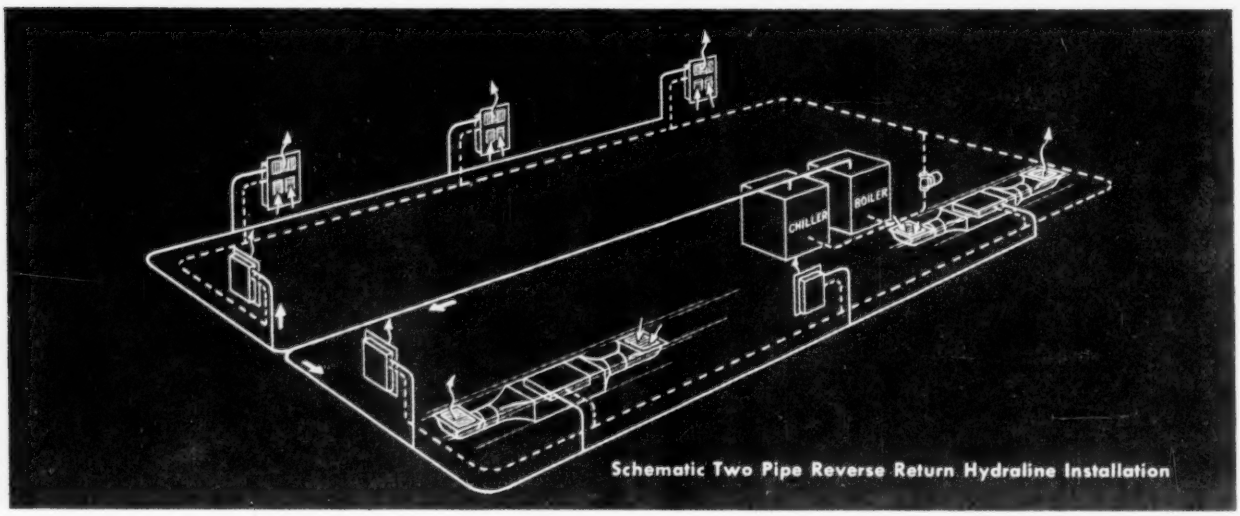
New Homes
Reconditioned Homes
Stores · Offices
Motels · Hotels
Hospitals · Schools
Factories and Plants

See other side for Hydraline details

Year 'Round *Hydraline* Room Air Conditioners

—can be installed on: (1) two pipe balanced reverse return systems, (2) single or multi-loop Monoflow parallel systems, (3) single or multi-manifold parallel systems. Hydraline Central Boilers, *Chillers, and Accessories are available in all sizes for complete system installations.

**If water at 45°-50°F. is available, no mechanical water chiller may be required.*



Schematic Two Pipe Reverse Return Hydraline Installation

Why *Hydraline* Products offer the wet heat industry its greatest opportunity

Compact, fully recessed units—Hydraline Basic Air Conditioning Units are only 17¾" x 14" x 4¾", and can be installed vertically flush to the wall between 16" studs or horizontally under floors between joists. Occupying no floor space, problems of furniture placement and room decoration are minimized.

Individual Room Control—Each Hydraline unit is equipped with a blower speed manual control. Automatic Control Kits also provide thermostatic control of individual room temperature.

Balanced Distribution—Independent operation of Hydraline units permits perfect temperature balance between rooms with either heating or cooling.

Individual Room Air Filters—Hydraline Units individually filter air as well as heat or cool each room. Filters may easily be removed by releasing the catch on return air registers, and cleaned as regularly as rugs, assuring a permanently dust-free room.

Perimeter Air Circulation—With Hydraline under floor units, location of the discharge register along outside walls and underneath windows free of the drape line, provides the desirable features of perimeter heating. Accessory stack heads for under floor installation are available for all conditions.

Most Sensitive Response—With individual forced air circulation, Hydraline units transfer heat and absorb heat over four times as fast as other forms of forced or central gravity systems, maintaining closest temperature control.

Radiant Panel Combination—With modulating controls, Hydraline Air Conditioning Units can be economically combined with Radiant Panel Heating where such combinations are advisable.

Lowest Possible Cost—Hydraline Air Conditioning Units cost no more than radiators; less than one-half the cost of other types of remote room conditioners; and less than one-third the cost of window-type room conditioners.

Ask your wholesaler for the complete Hydraline catalog or contact us direct by mail or wire.

BORG B-W WARNER

Hydraline **PRODUCTS**

BORG-WARNER CORPORATION

346 E. South St., Kalamazoo, Mich.

Water Boilers • Water Chillers • Heat Pumps • Domestic Water Heaters
Air Conditioning Units • Piping and Accessories

ANOTHER REPORT OF READING COPPER TUBING "ON THE JOB" . . .

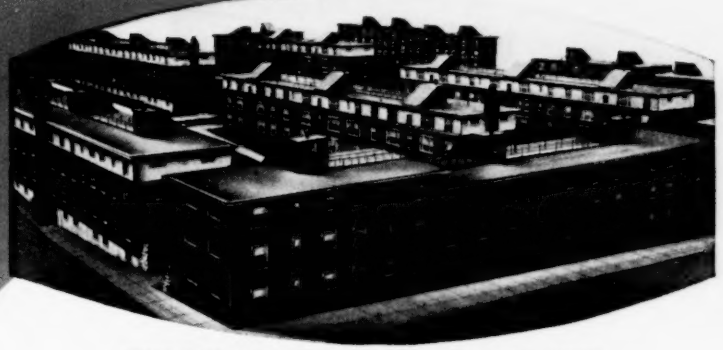
New England Plumbing Contractor*

Installs READING COPPER TUBE Exclusively in 274-Unit Housing Project!

[illegible] M. Kahn

Melvin Kahn

. . . *Benjamin M. Kahn & Son Prefers Reading Tubing because of Uniform Wall Thickness and Ease of Bending . . . Lower Installation Cost.



WEST ROXBURY HOUSING PROJECT, BOSTON, MASS.

ARCHITECT: Somes, Boyden, Griswold and Ames, Boston, Mass.

PLUMBING CONTRACTOR: Benjamin Kahn & Son, Medford, Mass.

The 274-unit West Roxbury Housing Project just erected for the City of Boston Housing Authority is the most recent installation in which Benjamin Kahn & Son, plumbing contractors of Medford, Mass., has used Reading Copper Tube exclusively.

The Kahn firm has been in business since 1926 and estimate they have installed approximately 581,395 feet of Reading Copper Tube in the past 5 years. They have learned from this long experience that Reading Copper Tube can be depended on for uniform wall thickness, precision manufacture to close tolerance standards, and reduced labor cost resulting from the elimination of many joints and fittings which is made possible by the ease of bending Reading Copper Tube on the job.

These important qualities are winning a steadily growing preference for Reading Copper Tube by plumbing and heating contractors everywhere for hot and cold water lines, radiant heating installations, air conditioning systems, underground service and processing lines.

Whenever you order copper tubing from your plumbing and heating supply wholesaler, remember to specify Reading . . . for a better job at less cost!

READING TUBE CORPORATION

Producers of Reading Lektroneal Copper Tubing and Reading 85% Grade A Red Brass Pipe

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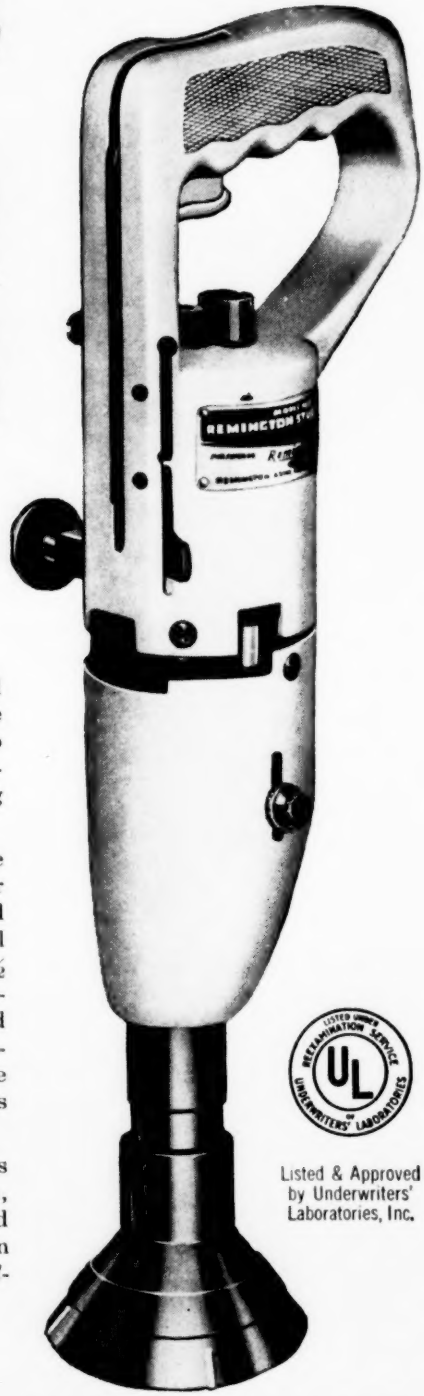
You can drive studs ARROW STRAIGHT into steel or concrete with

MODEL 450 REMINGTON STUD DRIVER

The widest power range of any powder-actuated tool!



The Model 450 Remington Stud Driver is the most efficient fastening method in use today. Its exclusive advantages are unequaled by any other powder-actuated tool.

You get consistently straight driving on every type of fastening job with the long heel cap on all Remington cartridges. It acts as a perfect gas seal and provides extra power. These colored heel caps clearly mark the six different 32-caliber power loads that are available. You can select the *right* cartridge for each job quickly and easily.

The Remington Stud Driver needs no separate parts for power control or loading—nothing to lose or break. Just a twist of the wrist opens the Model 450. Insert stud and power cartridge as a unit . . . close and you're ready. Triple safe, this superior tool has a separate lever that must be depressed and *held* with one hand before and during squeezing of the trigger with the other hand. Two *additional* devices prevent operation except in proper fastening position.

Completely self-powered, the Model 450 sets up to 5 studs per minute in fastening steel or wood structural pieces to concrete or steel surfaces. Its light weight—only 5½ pounds—makes it ideal for use overhead or in confined spaces. To speed operation further, an exclusive ejector snaps the fired case out of the tool instantly—no fumbling, no tools needed.

Test-proved to be the world's finest and speediest fastening system, the Model 450 Remington Stud Driver is made by Remington Arms Company, Inc., *America's oldest sporting arms manufacturer.*

Listed & Approved by Underwriters' Laboratories, Inc.

MAIL THIS COUPON TODAY

Industrial Sales Division, Dept. HV-7
Remington Arms Company, Inc.
939 Barnum Ave., Bridgeport 2, Connecticut

Please send me my *free* copy of the new booklet showing how I can cut my fastening costs.

*Name*_____

*Position*_____

*Firm*_____

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NEW, FREE BOOKLET shows you a hundred different ways the Model 450 Remington Stud Driver can speed *your* construction fastening. Packed with illustrations, it tells you where and how this tool can save time, reduce fatigue and cut costs. Send in the coupon below for your copy.

"If It's Remington—It's Right!"

Remington DUPONT

BIG TONNAGE CONTROL FOR SHELL AND TUBE COOLERS

75 to 200 TONS F-12

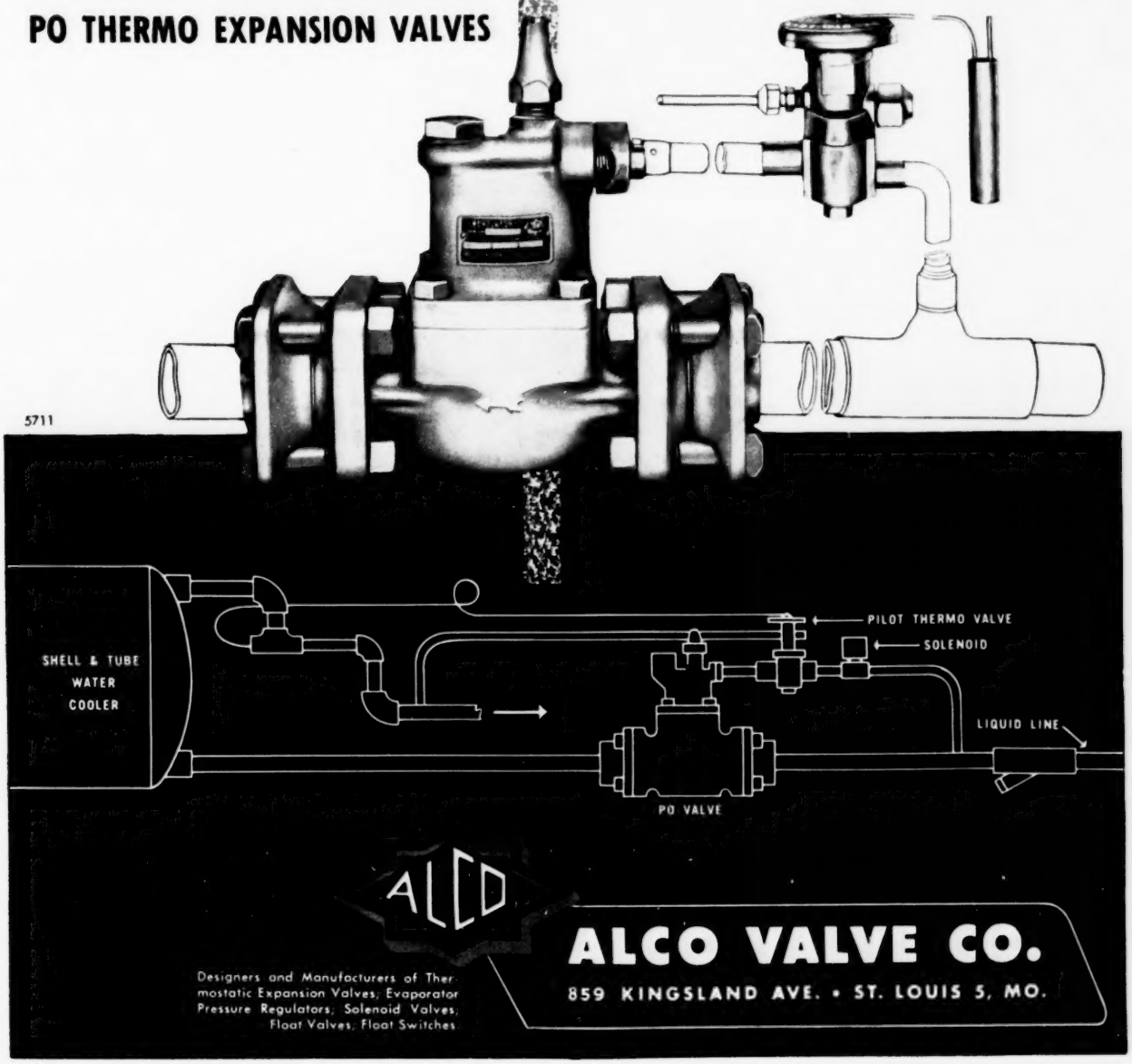
with ALCO PO THERMO EXPANSION VALVES

Alco PO Thermo Valves have only a few moving parts. Any change in superheat operates a small pilot Thermo Valve which automatically controls the PO Valve.

Both pilot and main valves have Alco's famous come-apart construction. Like all Alco products, they are easy to install and service.

May we send you FREE our PO Bulletin with complete technical information and installation data?

SEE YOUR ALCO WHOLESALER



ALCO

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Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators, Solenoid Valves; Float Valves, Float Switches

What can be done to stop —

AIR POLLUTION?

The answer is "plenty"! Sure there are problems yet to be solved—and new ones will be created as industry develops and expands. But the fact remains that *dust*, one of the major factors in most air pollution problems, has been and can be controlled effectively.

The American Air Filter Company first tackled industrial air pollution over 20 years ago. Since then, AAF engineers have literally "lived" with industry's many and varied dust problems. Result — ROTO-CLONE—the world's most complete line of dust control equipment.

Today, over 20,000 ROTO-CLONE units are helping industry to forestall court injunctions, citizens committees and irate housewives by removing that major irritant —dust. With dust under control, the other problems of air pollution often disappear or take on less importance.

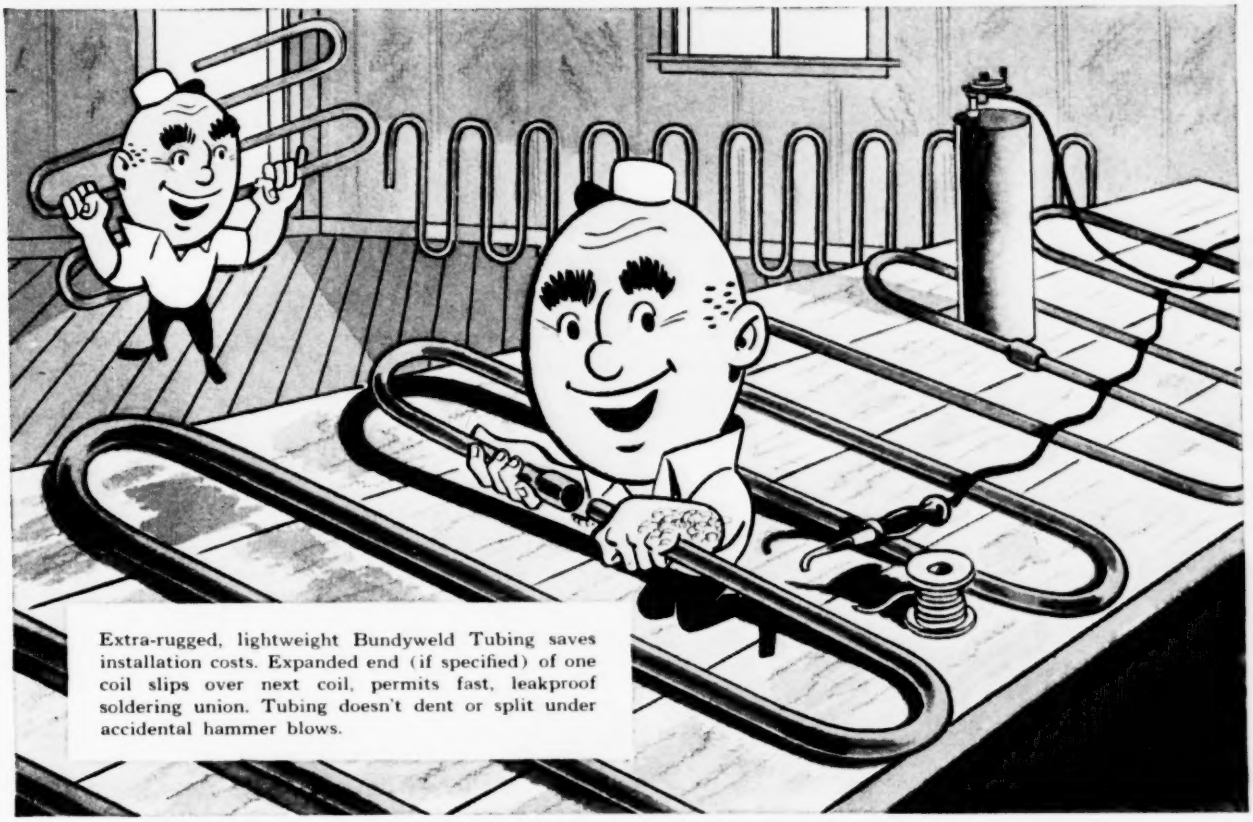
Start now by appointing your local AAF representative as a "committee of one" to check your present dust sources and recommend effective means of control. Call him, today, or write us direct. Remember—"big air pollution problems from little dust sources grow".

You Can Expect the Best From

American Air Filter
COMPANY, INC.

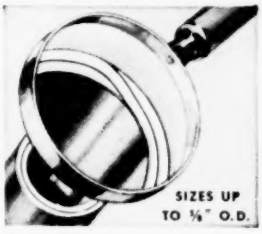
AAF

294 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.



Extra-rugged, lightweight Bundyweld Tubing saves installation costs. Expanded end (if specified) of one coil slips over next coil, permits fast, leakproof soldering union. Tubing doesn't dent or split under accidental hammer blows.

Ease right past local competition . . . with Bundyweld Ceiling Radiant Heating



Key to Low Cost

Bundyweld is the only tubing double-walled from a single strip, copper-brazed through 360° of wall contact. It's leakproof, thinner walled, yet stronger. It transmits heat quickly, has high bursting strength. It saves on material costs and installation time.

Standard 20′ lengths of Bundyweld are easily formed into coils in shop or on job site. Expanded ends (furnished when specified) are quickly soldered into leakproof union. Joined, lightweight coils are easily mounted onto ceiling, quickly plastered over.

You can ease right past, take business from competitors who still install tricky, obsolete heating systems.

Why? Because you can *save* time and labor, get "bonus" profits by taking on Bundyweld Ceiling Radiant Heating.

Contractors all over the country find rigid, lightweight, leakproof Bundyweld far easier, quicker to bend and position than any other tubing. Customers find the system free of drafts, dust, soot; even-temperatured and economical. Bundyweld Ceiling Radiant Heating eliminates space-stealing radiators and registers; postpones redecorating *years*.

These *user* comments reach thousands of near-ready home buyers and builders, who also get the story of this revolutionary system through Bundy ads in *Better Homes & Gardens*, *American Home*, *Small Homes Guide*, and *House Beautiful*. Are they convinced? Well, we've answered *nearly a ton* of requests for literature, *names* of local plumbing and heating contractors handling Bundyweld Ceiling Radiant Heating.

The system makes sales; it's simple to install. Why not make more money on the biggest heating advance in years? Mail coupon *now* for the full story.

Radiant Heating Division

BUNDY TUBING COMPANY

Detroit 14, Michigan

SEND FOR FREE LITERATURE!

Bundyweld
Ceiling Radiant Heating

Radiant Heating Division, Dept. HV-753
Bundy Tubing Company, Detroit 14, Mich.

☐ Send free 20-page nontechnical brochure explaining Bundyweld Ceiling Radiant Heating.

☐ Send Bundy technical radiant heating pamphlet.

Name _____ Title _____

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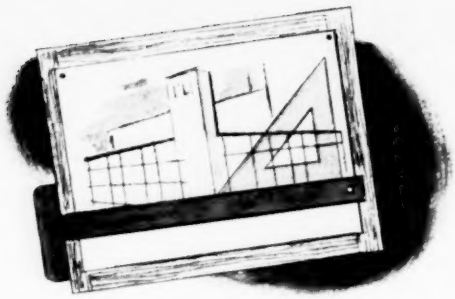
BRUNNER
SINCE 1906

DESIGNED FOR YOUR AIR CONDITIONING REQUIREMENTS



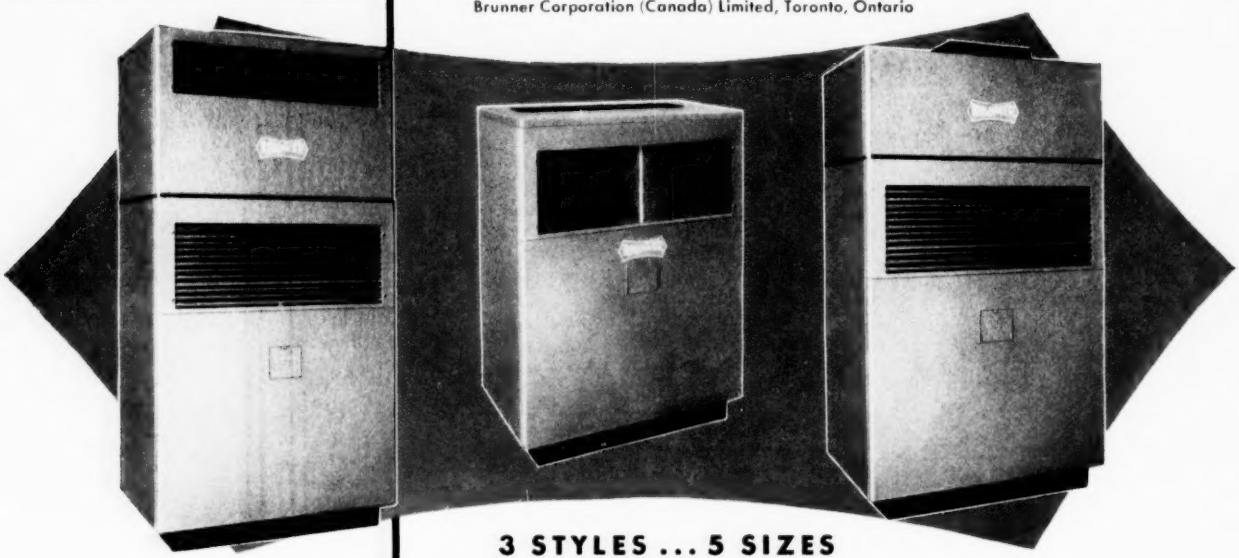
For the many installations where efficiency and economy must be combined with application flexibility—these new "packaged" BRUNNER AIR CONDITIONERS are the answer! Precision-built, powered by the famous Brunner quiet slow-speed compressors—these self-contained units permit complete freedom of application planning for every type of job. Easy to install anywhere—and, like all Brunner products, they are engineered for fast, simple servicing *in the field.*

15 models to choose from—for within room-circulating or remote duct operation. Attractive enamel cabinets clean easily—blend into any decorative plan. A FIVE YEAR WARRANTY on the Brunner Compressor in every unit assures satisfactory service. See these BRUNNER Air Conditioners... see how they can fit *profitably* into *your* air conditioning picture...

as seen in... The Saturday Evening POST

Brunner Manufacturing Company
Dept. K-73, Utica, New York, U. S. A.

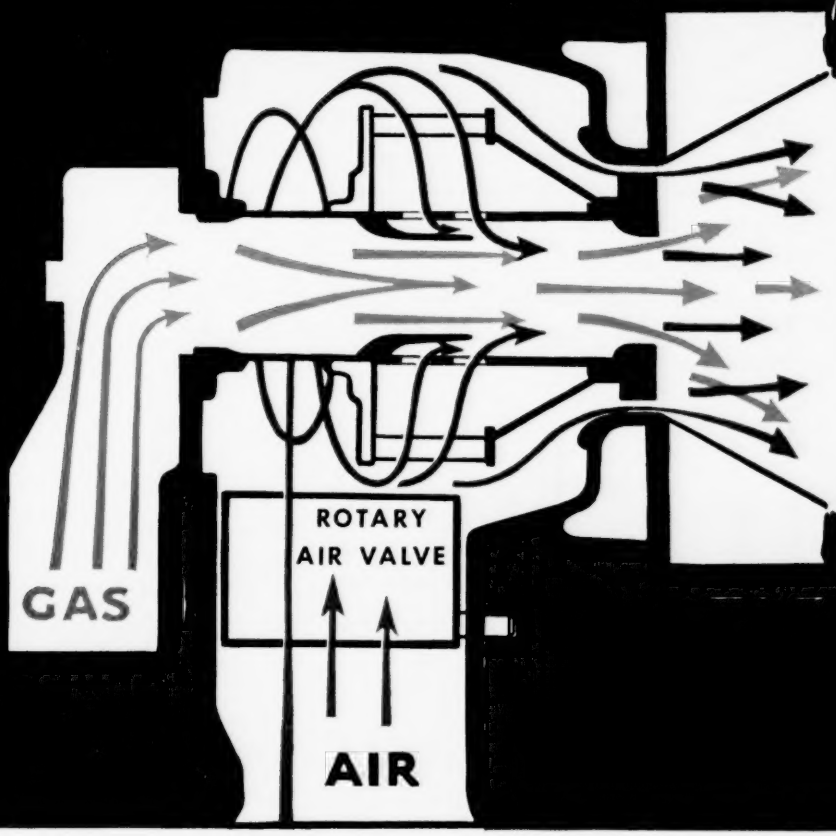
IN CANADA:
Brunner Corporation (Canada) Limited, Toronto, Ontario



3 STYLES ... 5 SIZES

Brunner Air Conditioners are available in 3 styles (shown above)—each style in 2, 3, 5, 7½ and 10 H.P. sizes. Complete information, specifications and ratings sent upon request.

YOU'LL ALWAYS BE GLAD YOU INSTALLED A BRUNNER SINCE 1906



another cost-saving feature of POWERMASTER packaged automatic boilers!

The *VORIFLOW*® Gas Burner

Keeps fuel costs DOWN ...boiler efficiency UP

You can always depend on getting highly efficient and economical gas-firing with a Powermaster packaged automatic boiler because the Powermaster VORIFLOW gas burner gives you these operating advantages:

1. Infinitely Variable Combustion Modulation

Fully automatic control of fuel and combustion air responds instantly to load demands ranging from 20% to 100% of firing capacity—*with full efficiency!* There's no fuel-wasting combustion with the VORIFLOW gas burner because properly proportioned fuel and air are thoroughly pre-mixed to insure immediate ignition and complete burning upon entering the combustion chamber. All components of this unique burner are carefully sized for the Btu content of the gas supply and the heat requirements of the boiler.

2. High Efficiency Design and Construction

In the VORIFLOW burner, gas flows through the central gas nozzle from the gas plenum. Combustion air from the blower enters the air plenum, proportioned automatically by the motor operated rotary air valve. Primary pre-mixing air is captured by a stationary compressor wheel. This assembly directs the pre-mixing air through perforations into the gas nozzle against venturi-shaped air baffles. The gas and air are thoroughly mixed enroute through the gas nozzle. The outer air ring controls the amount of secondary combustion air admitted to the combustion chamber.

3. Immediate Change-Over to Alternate Fuels

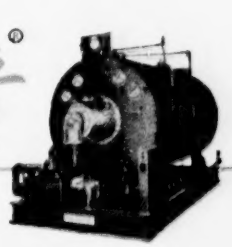
Conversion from gas to oil firing, or vice versa, with this VORIFLOW burner is accomplished in a few seconds on combination units. With the flick of an electric switch, the Powermaster modulating firing controls go into action as soon as the fuel change-over is completed. Latest development for gas firing of packaged boilers, this VORIFLOW burner is one of many reasons why Powermaster is so widely preferred for industrial plants, dairies, hospitals, laundries, schools, public buildings, institutions, and other steam and hot water boiler requirements.

Send for this new bulletin to get the full story of Powermaster's many cost-saving features.

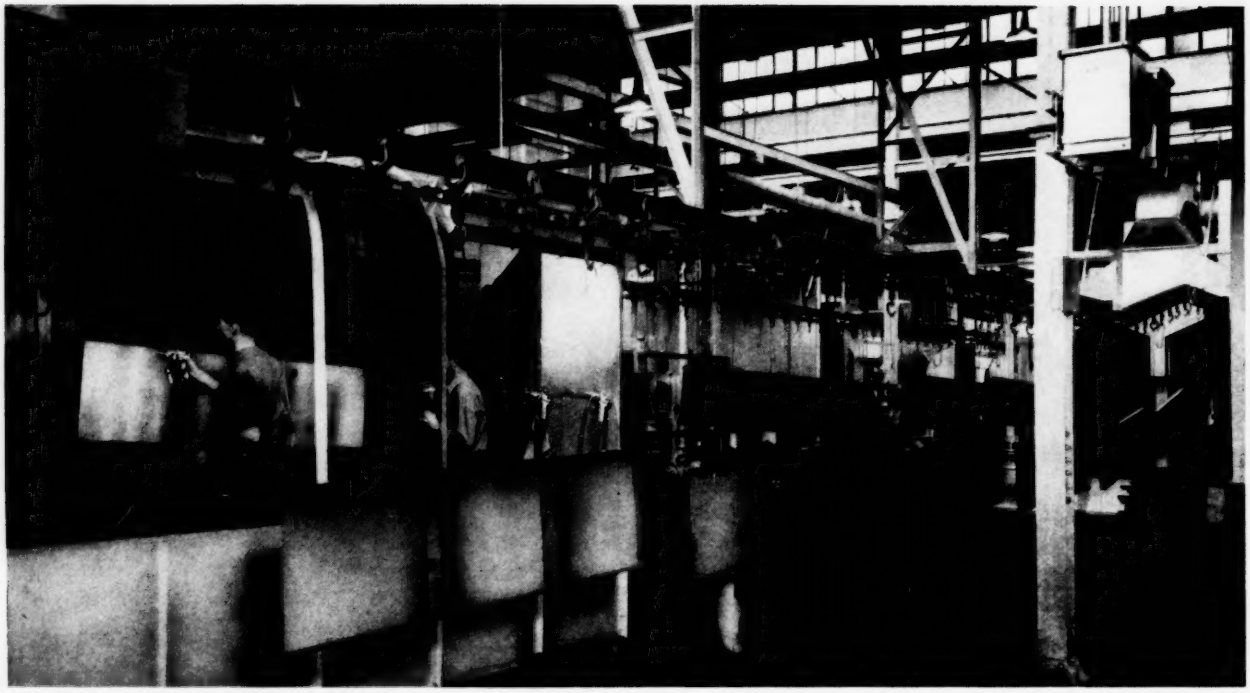
Powermaster®

PACKAGED AUTOMATIC BOILERS

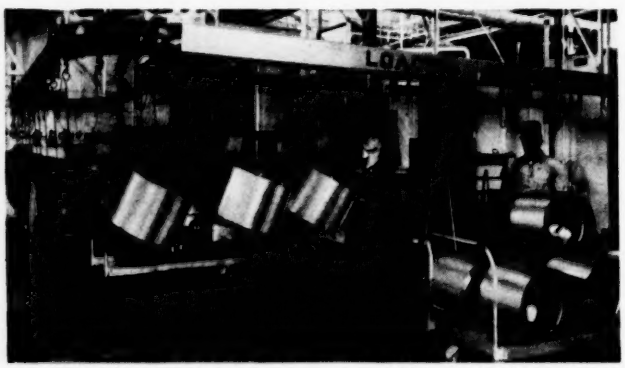
In sizes to 500 HP; pressures to 250 psi.



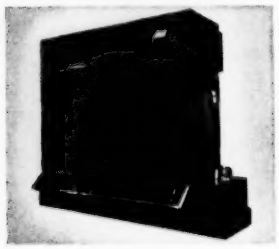
ORR & SEMBOWER, INC. • Established 1885 • **980 Morgantown Road, Reading, Penna.**



SPRAYING CORROSION-RESISTANT ENAMEL on metal panels for Worthington evaporative condensers and air conditioners. This chlorinated rubber base enamel, selected by Worthington after rigorous tests, resists chipping and long exposure to salt fog, acids, alkalis, ultra-violet light, and high and low temperatures.



FAN HOUSINGS ARE LOADED on conveyor which carries them through Worthington special 5-stage washing process. This washing, which includes sprays of Bonderite and mild chromic acid solution, prepares the equipment for the corrosion-resistant enamel.



YEARS OF TROUBLE-FREE SERVICE are assured with this Worthington evaporative condenser. The corrosion-resistant finish, rugged construction, large diameter hollow fan shaft and self-aligning ball bearings are some of the features that make this unit the finest available. You can get a Worthington evaporative condenser in any one of 18 sizes, in capacities of 10 to 150 tons.

Rustproof finish adds years to life of air conditioning equipment

For years, corrosion has presented a real problem in air conditioning and refrigeration equipment. Brine spray, water, fumes—all caused metal equipment to corrode. To combat this, Worthington engineers developed the bonderized two-coat baked chlorinated rubber enamel finish now used on all Worthington air conditioning and refrigeration units.

This finish, the result of years of testing and research, completely protects the metal against corrosion and preserves the original appearance of the equipment. Rigorous tests have shown that this finish will last at least three to four times longer than the best hot-dipped galvanizing coating.

Advances in construction and design like this are standard practice with Worthington, a leader in air conditioning and refrigeration for over half a century. From giant industrial refrigeration systems down to the air-conditioner for a baby's nursery, Worthington can handle any job, and provide exactly the right equipment. So when you think of air conditioning or refrigeration—think of Worthington.

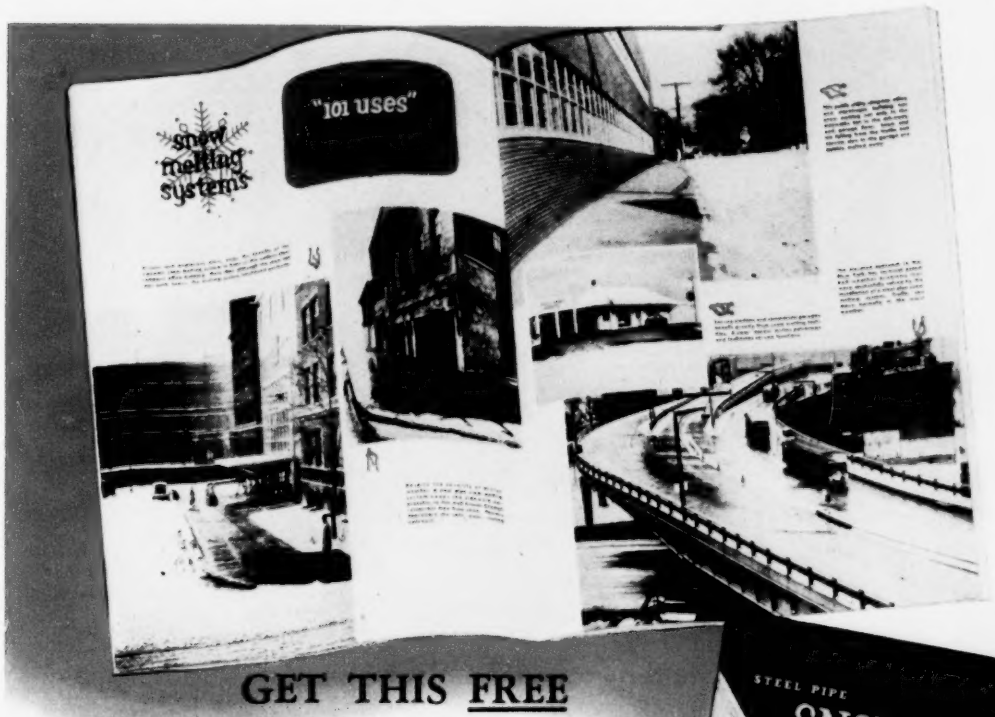
For more information, get in touch with your nearest Worthington distributor. Or write to Worthington Corporation, Air Conditioning and Refrigeration Division, Section A.3.40, Holyoke, Mass.

A.3.40

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

Cash in on the big, new market for snow melting systems



GET THIS FREE 32 PAGE BOOKLET

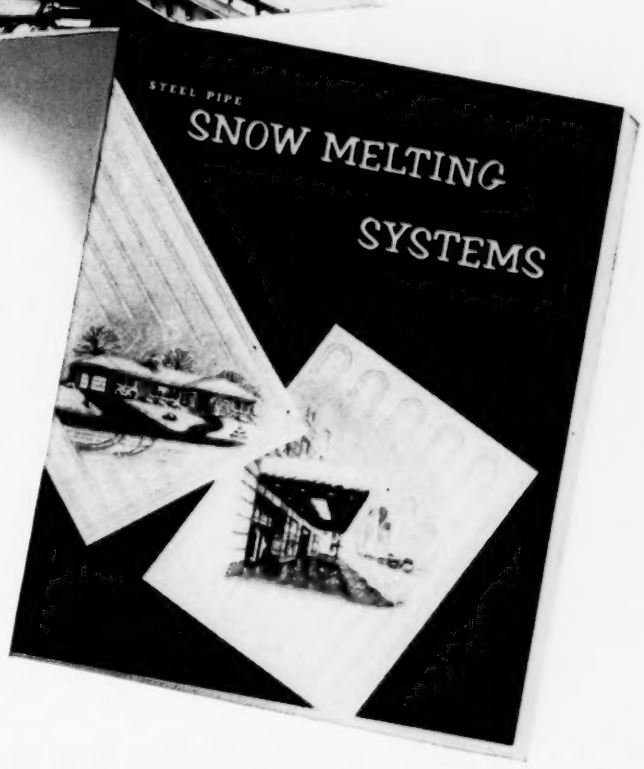
The tremendous public interest in the benefits of snow melting systems now extends the frontiers of the plumbing and heating business to embrace a great, new multi-million dollar market annually.

This is *new* business . . . business that never existed before . . . business that proves that a saturation point is far from being reached!

To give you a better picture of the scope of this profitable new market, the Committee on Steel Pipe Research has prepared an attractive and easily understood booklet for anyone interested in snow melting.

It answers the most commonly asked questions about snow melting systems, suggests applications for domestic, commercial and industrial uses. It covers such important subjects as design, steel piping layouts, temperature requirements, boiler capacities, auxiliary equipment, and step-by-step installation methods.

You can get this valuable color booklet without cost or obligation by returning the coupon below or by a request on your business letterhead to



COMMITTEE ON STEEL PIPE RESEARCH
AMERICAN IRON AND STEEL INSTITUTE
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Steel Pipe is First Choice

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Please send me without cost or obligation a copy of the 32 page booklet "Steel Pipe Snow Melting and Ice Removal Systems."

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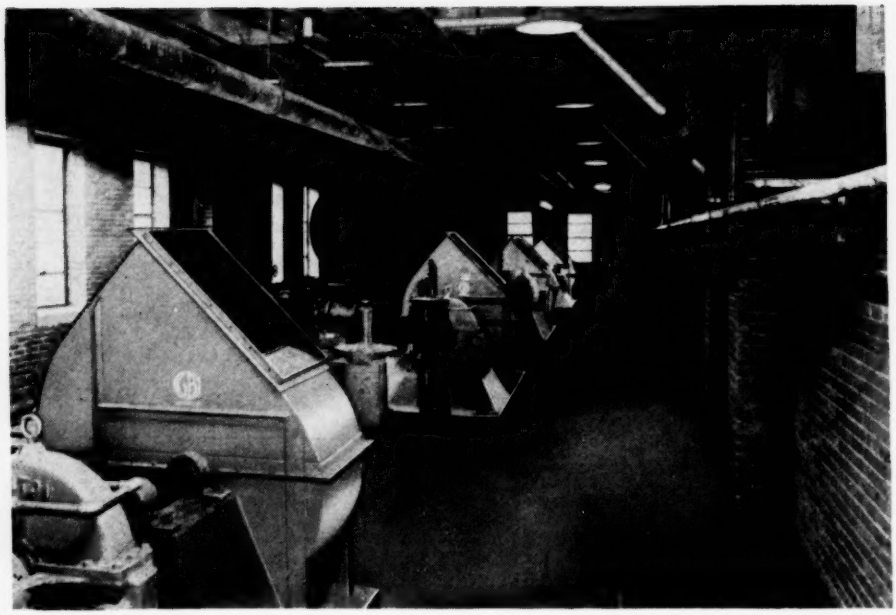
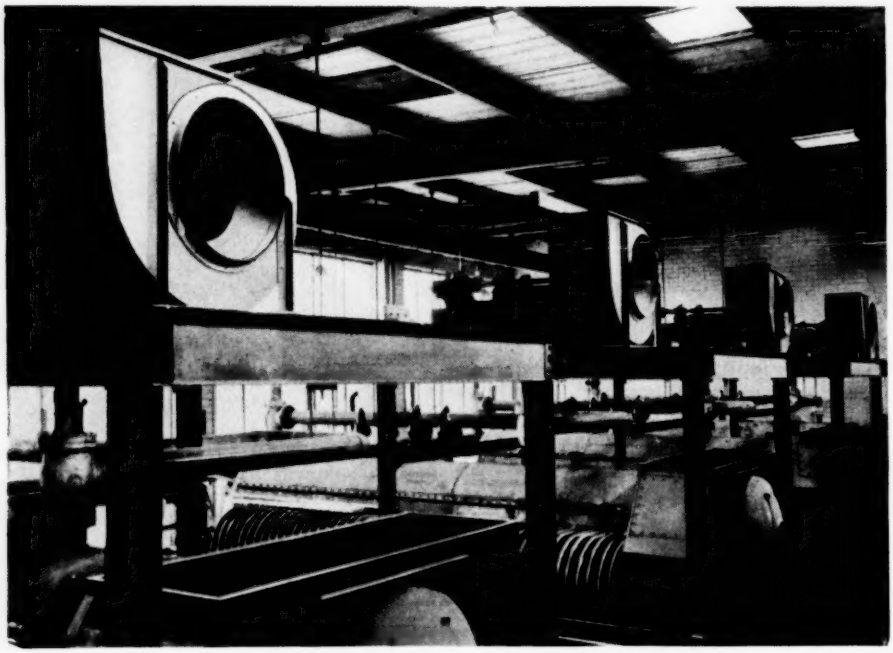


GENERAL
BLOWERS
for

POWER +

Shown on the above is a GENERAL BLOWER installation of forced draft fans for the Middletown State Hospital.

Power plus rugged construction, faithful round the clock operation and scientific engineering make GENERAL BLOWERS a must for your next heating installation. Whether it is a heating or ventilating installation, individual care is given each blower to guarantee you the most efficient blower that can be purchased.



Shown on the left is a GENERAL BLOWER installation of induced draft fans for the Long Island Agricultural and Technical Institute at Farmingdale, Long Island.

Write for descriptive literature
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GENERAL BLOWER COMPANY
8622 FERRIS STREET
MORTON GROVE, ILLINOIS

SALES & ENGINEERING OFFICES
In Principal Cities all over U. S. A.

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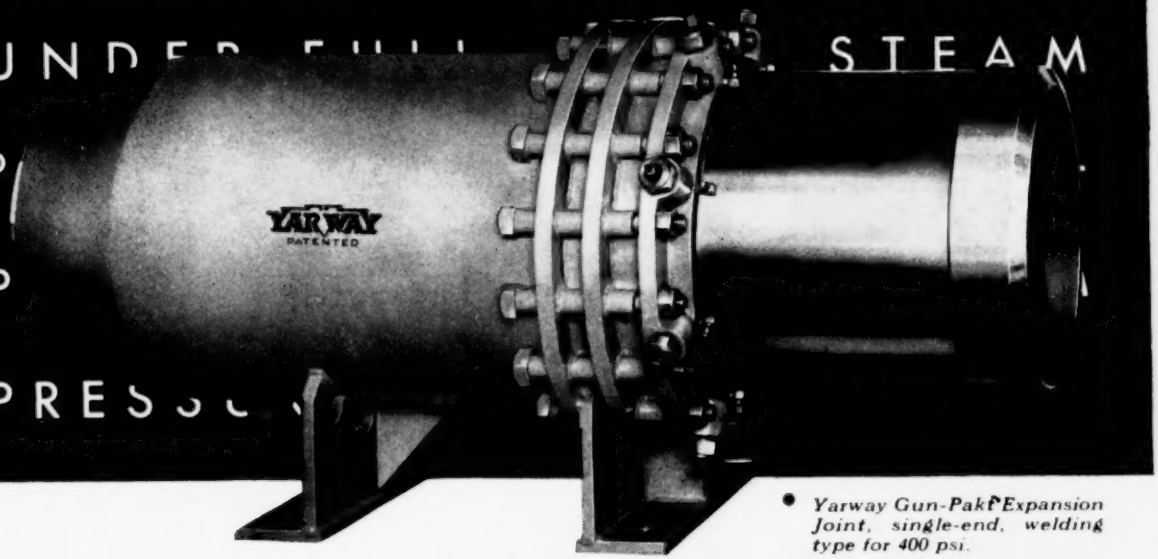
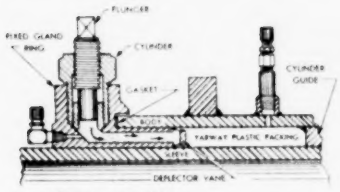
LUNGS FOR INDUSTRY
DESIGNERS — ENGINEERS — MANUFACTURERS OF FANS, BLOWERS EXHAUSTERS AND RELATED INDUSTRIAL EQUIP.

GUN-PACKED UNDER FULL STEAM PRESSURE • GUN-PACKED UNDER FULL STEAM PRESSURE • GUN-PACKED UNDER FULL STEAM PRESSURE



• *Yarway Gun-Pakt Expansion Joint, single-end, welding type for 400 psi.*

BEHIND IT...AN ENGINEERING REASON



Cross-section of Gun-Pakt feature.

More large central station heating plants are using Yarway Gun-Pakt Expansion Joints in their steam distribution lines than any other type. This popularity of Yarway Gun-Pakt Expansion Joints in public utilities, institutions and industrial plants is due to the engineering reason behind them . . . *they are packed by a gun under full steam pressure.*

No shutdowns of steam lines, no production delays . . . you just insert a plug of Yarway plastic packing, twist a wrench, and the joint is tight, the job is done.

Such labor saving features, combined with impressive records of low maintenance requirements, make Yarway Gun-Pakt Joints a natural selection for your steam lines. Certainly you'll find them worth investigating.

Write for Yarway Expansion Joint Bulletin EJ-1912.

YARNALL-WARING COMPANY
104 Mermaid Avenue • Philadelphia 18, Pa.

YARWAY | ***gun-pakt expansion joints***

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1000
Types and Sizes
FOR YOUR
SELECTION

The complete Deming line offers industrial users of pumping equipment more than 1000 types and sizes of units for selection . . . or more than 10,000 if you include the full ranges of capacities, heads, types of mountings and power drives.

Catalog bulletins on all types of Deming Pumps are available upon request. It will be a pleasure to work with you in the selection of the most efficient pumping units for specific job requirements.

DEMING DISTRIBUTORS LOCATED EVERYWHERE

Close cooperation between Deming field engineers and Deming Distributors makes a hard-to-beat combination of sales-engineering "know-how" to serve your pumping needs. If you don't know where to locate the nearest Deming Distributor, write us.

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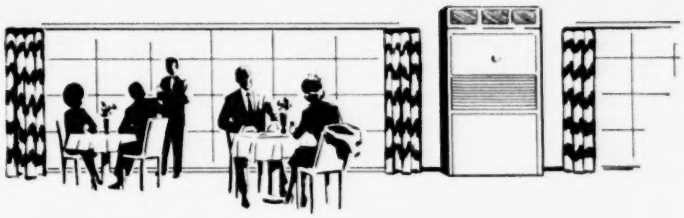


MADE TO BE QUIET!

Chrysler Airtemp "Packaged" Air Conditioning is designed and engineered to give QUIET operation. This allows the unit to be installed nearer to room occupants without disturbing them. It may mean less ductwork . . . greater installation economy.

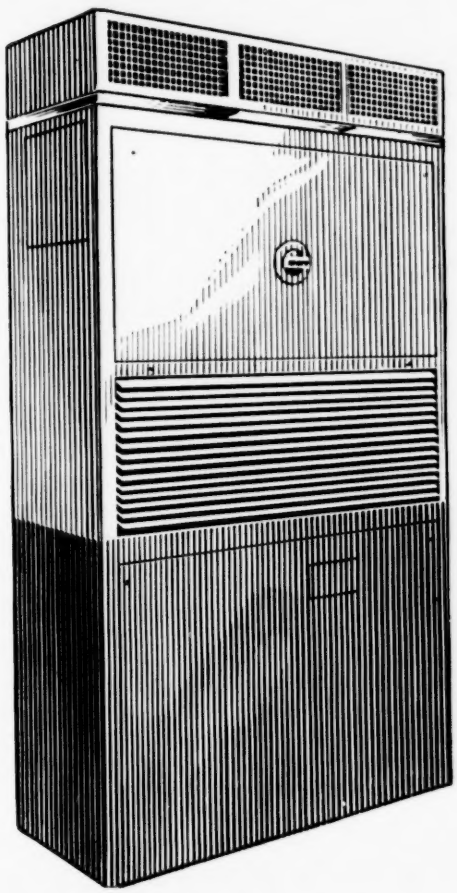
But that's not all! Quietness and freedom from vibration contribute to long life and years of trouble-free service.

Here are just three of the many reasons for the amazingly quiet performance of Chrysler Airtemp Packaged Air Conditioning:

- Vibration is reduced to a minimum in the compact radial compressor, because the compressor design permits perfect balance regardless of the number of cylinders.
- Transfer of any noise or vibration within the air conditioner is prevented by flexible connections in both the suction and discharge lines.
- For super-quiet performance the compressor is supported from rubber mountings. There is no metal to metal contact.

Get all the facts today. See why it will pay you to sell the "Packaged" Air Conditioning most people buy—Chrysler Airtemp!

Comfort Zone FOR PROFIT



"Packaged" Air Conditioners
Six water-cooled models 2 to 15 H.P. and 2 and 3 H.P. air-cooled models meet most cooling needs.

Guaranteed by Good Housekeeping

Chrysler Airtemp

HEATING • AIR CONDITIONING
***for* HOMES, BUSINESS, INDUSTRY**
Airtemp Division, Chrysler Corporation, Dayton 1, Ohio

Airtemp Division, Chrysler Corporation H&V 7-53
P.O. Box 1037, Dayton 1, Ohio

Please send full details on the Chrysler Airtemp Comfort Zone "Packaged" Air Conditioning proposition.

Name _____

Address _____ Phone _____

City _____ Zone _____ State _____

On again!

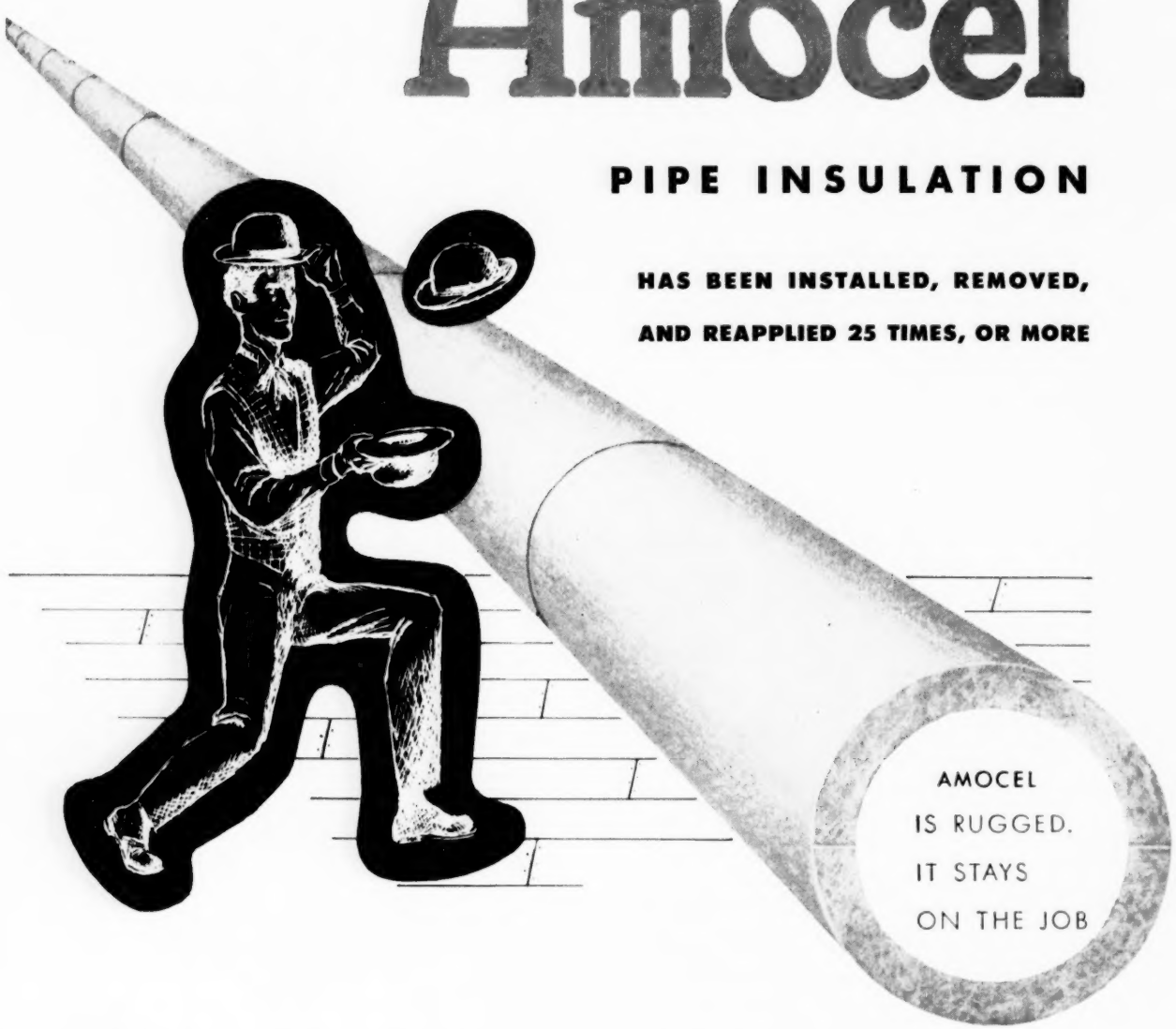
Off again!

Amocel®

PIPE INSULATION

HAS BEEN INSTALLED, REMOVED,

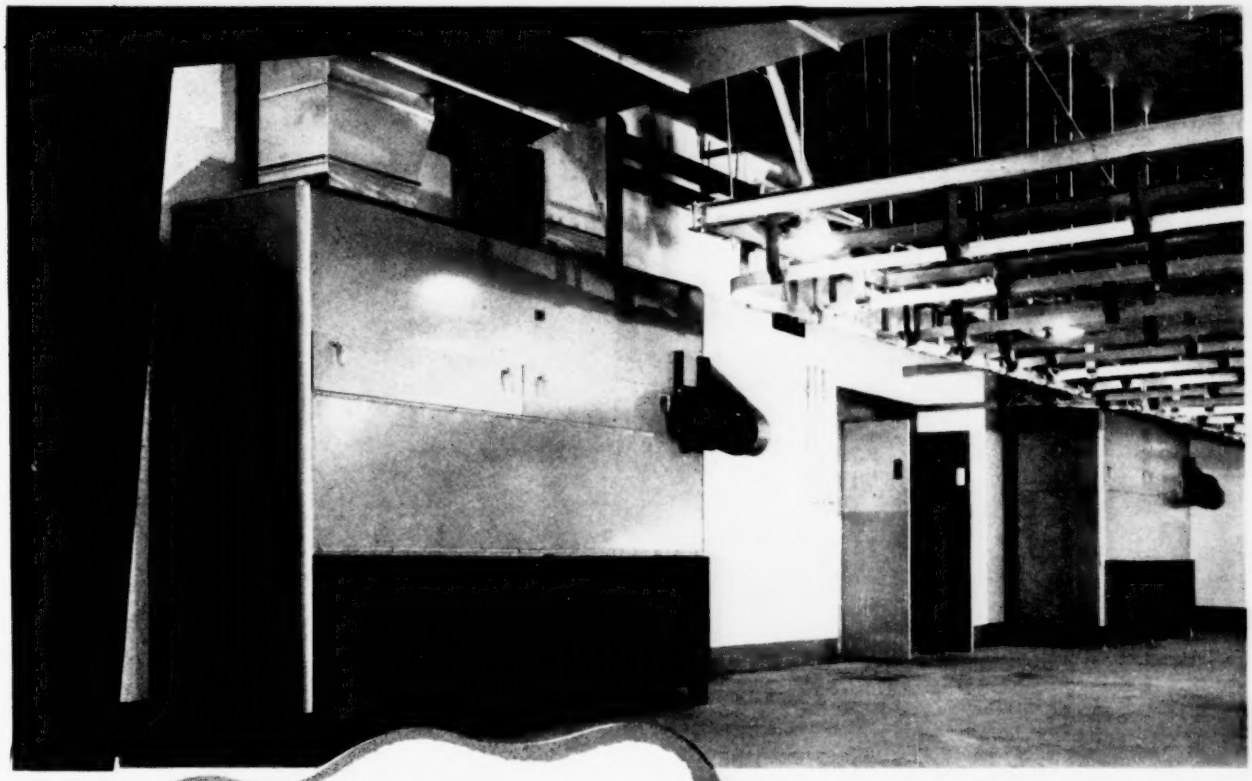
AND REAPPLIED 25 TIMES, OR MORE



UNARCO

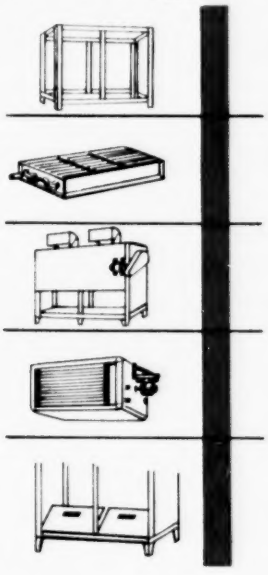
UNION ASBESTOS & RUBBER COMPANY

DEPT. B-7, 332 SOUTH MICHIGAN AVENUE, CHICAGO 4, ILLINOIS



big product cooling job?...

BUSH PRODUCT COOLERS WILL INSURE A GOOD JOB



Bush units are constructed around rigid angle iron frames which support bearings, shaft and motor. This construction guarantees alignment . . . eliminates fan troubles, and insures quiet operation.

Large amount of coil surface allows low air velocity, minimizing dehydration of produce. Coils are circuited to provide maximum capacity with minimum pressure drop.

Bush product coolers are available in floor or ceiling models, with top or front outlets and directional louvers.

Low temperature water defrost units are equipped with ample water spray nozzles, insuring complete coil coverage—positive defrosting. Baffles on air inlet eliminate splashing during defrosting.

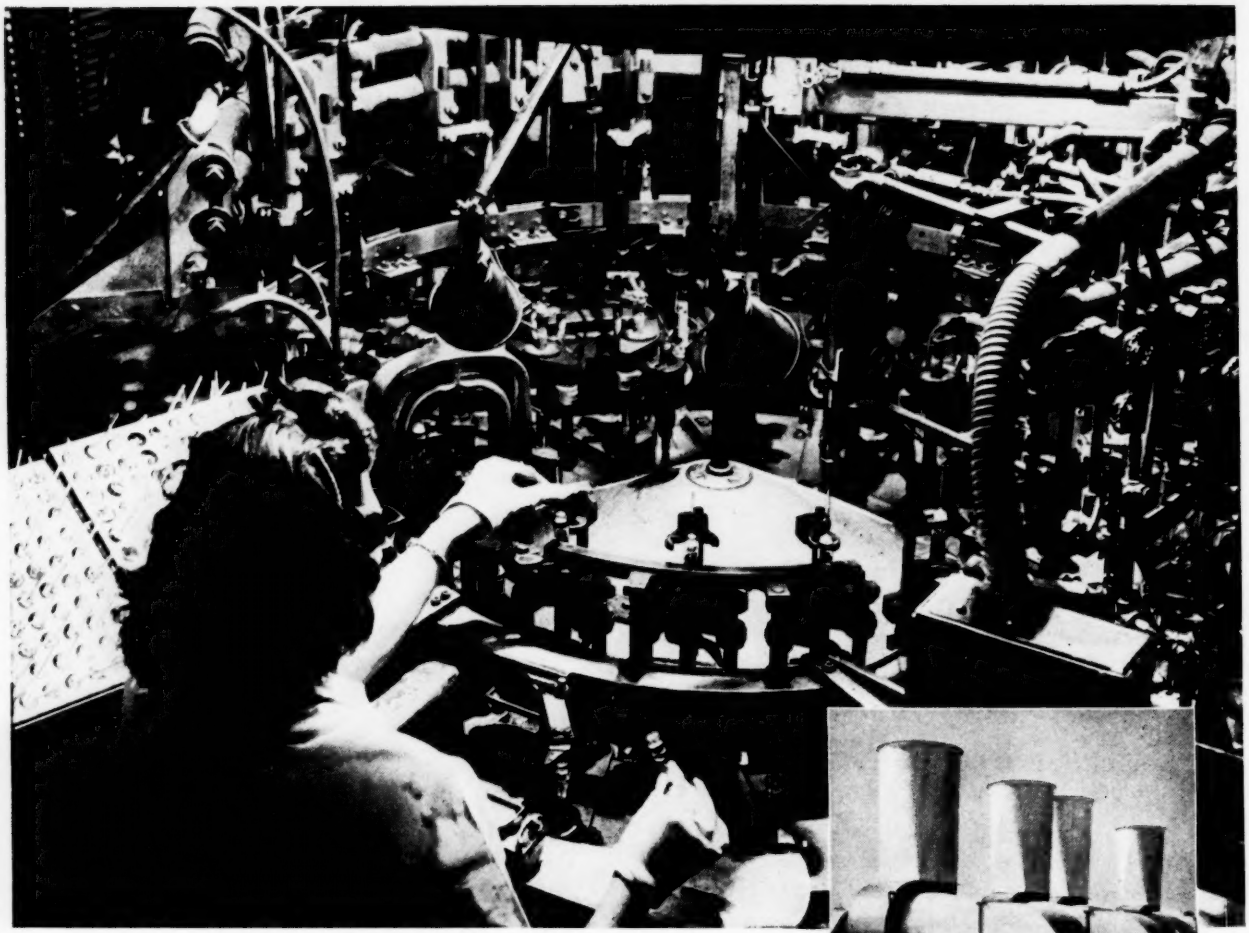
Wide range of sizes and styles makes Bush Product Coolers your best bet on all cold storage applications: fruit, meat and produce packing and storage plants . . . fur and fabric storage, frozen foods, locker plants . . . dairy products, candy storage, fish storage, etc.

CONSULT YOUR NEAREST BUSH SALES ENGINEER ON ANY PRODUCT COOLING PROBLEM. HE'LL BE GLAD TO HELP OUT.

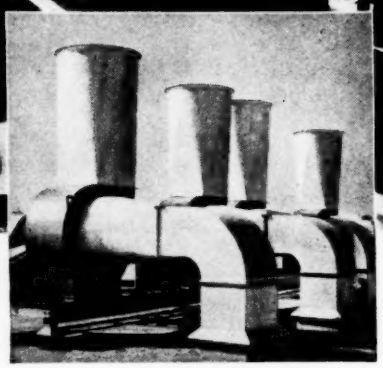
WRITE FOR COMPLETE INFORMATION.

BUSH MANUFACTURING COMPANY

WEST HARTFORD 10, CONNECTICUT



Putting Air to Work for RCA: Special machines for mass production each create 112,750 BTU's, cause special problems.



Ten Westinghouse fans exhaust the intense heat caused by flame jets and induction heating. This highly efficient Silentvane® fan does the job well, requires little maintenance.

Installed by Kirk & Blum Manufacturing Co., Cincinnati. Consulting Engineer: Paul P. Kopf, Philadelphia.

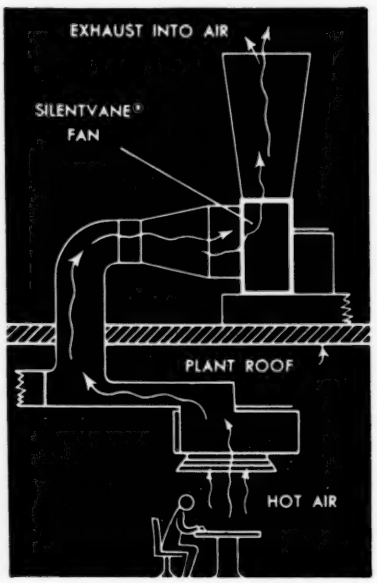
2,900,000 BTU EXHAUSTED

—OPERATORS STAY AT PEAK EFFICIENCY

Turning out miniature electron tubes is a hot business at RCA. Using a gas flame and induction heating, the process develops 2,931,200 BTU every hour. Exhausting this heat permits operators to work at peak efficiency.

Dependable Westinghouse fans handle the heat removal. They're rugged, can easily take the intense heat. And they do it quietly, efficiently.

If *you* have a heat exhausting requirement, or need ventilation for any purpose, let us help you. Westinghouse makes the most complete line of air handling, air conditioning and electronic air cleaning products available. Call your Westinghouse-Sturtevant office, or write: Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.



WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE...IF IT'S Westinghouse

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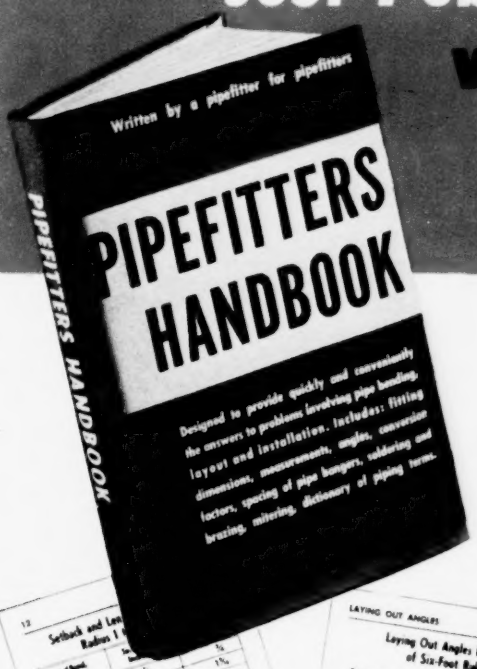
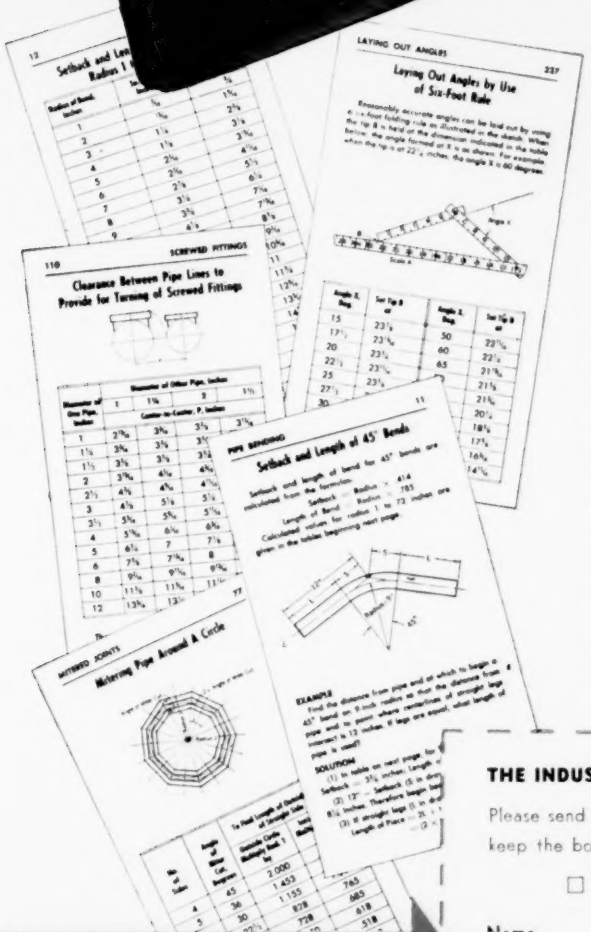
Just Published! A HANDBOOK WRITTEN ESPECIALLY TO SOLVE AND SIMPLIFY PIPEFITTING PROBLEMS


Written by a pipefitter for pipefitters
PIPEFITTERS HANDBOOK
Designed to provide quickly and conveniently the answers to problems involving pipe bending, layout and installation. Includes: fitting dimensions, measurements, angles, conversion factors, spacing of pipe hangers, soldering and brazing, mitering, dictionary of piping terms.
PIPEFITTERS HANDBOOK


Laying Out Angles by Use of Six-Foot Rule
Clearance Between Pipe Lines to Provide for Turning of Screwed Fittings
Setback and Length of 45° Bends
Metering Pipe Around A Circle

PIPEFITTERS HANDBOOK is written especially to enable pipefitters quickly to solve problems met either in the shop or in the field in connection with pipe bending, mitering, layout, threading, etc. The author, Forrest R. Lindsey, is a union pipefitter with over 35 years' experience. A large part of the book is taken directly from original tables which he has developed over a long period of time as a result of his experience with practical problems. These tables eliminate the necessity for making lengthy calculations by giving immediate answers to all kinds of pipefitting problems. Typical pages shown at the left illustrate the intensely practical nature of the information in the PIPEFITTERS HANDBOOK. The actual size of the book is 4" x 7", and it is bound in flexible maroon Fabrikoid so that it will fit conveniently into a pocket. It is printed in large type on durable paper, so that smudging with soiled hands will not obliterate the characters.

Page After Page of Valuable, Practical Data!

PIPEFITTERS HANDBOOK provides information on all the following subjects: Pipe Bending—Offsets—Mitered Joints—Standard Pipe Dimensions and Thread Data—Screwed Fittings—Butt Welding Fittings—Flanged Fittings—Valves—Solder Joint Fittings—Other Pipe Data—Miscellaneous Data on sheet metal, properties of steam, melting points of metals, etc.—Mathematical Tables, Conversion Factors, Use of Trigonometry—Pipefitters Dictionary . . . a total of 282 time-saving, work-improving pages of information.

Examine this New Handbook Free!

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Engineers: Hubbard, Lawless & Blakeley
Contractor: A. L. Butler & Company

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POWERS

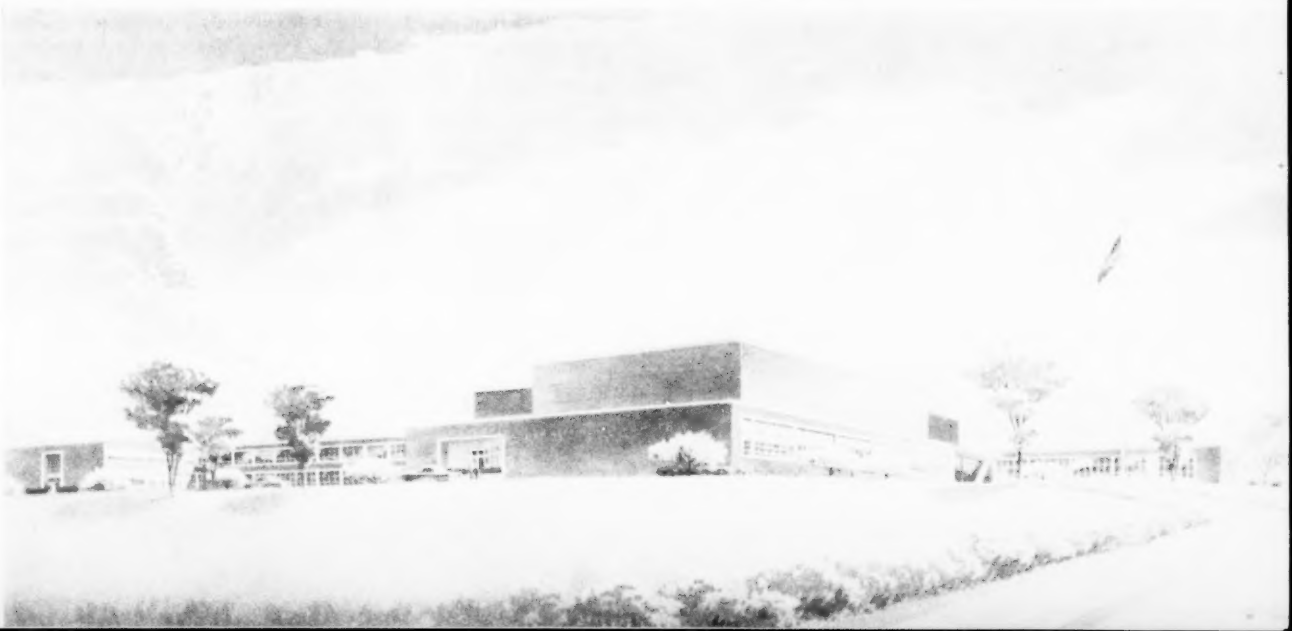
Below: SOUTH CARDENAS JUNIOR HIGH SCHOOL, ALBUQUERQUE, N. M.

Architect: Louis G. Hesselden
Engineer: Boyd Engineering Company
Contractor: Southwest Plumbing & Heating Co.

POWERS

Below: WILLIAM NOTTINGHAM HIGH SCHOOL, SYRACUSE, N. Y.

Architects: Vedder & Curtin
Engineer: Cedric R. Acheson
Contractor: James H. Martin, Inc.



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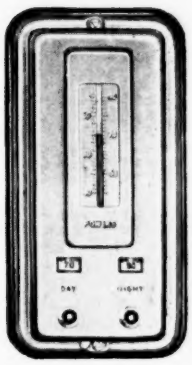
Temperature Control



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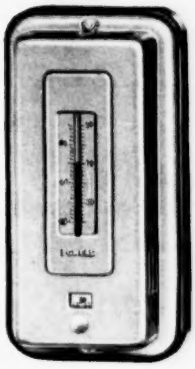
Insures comfort in classrooms by holding accurate Unit Ventilator discharge temperatures. Requires no auxiliary devices. Has adjustable sensitivity.



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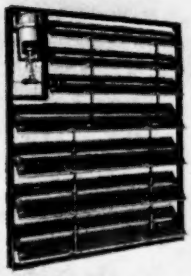
Unsurpassed for maintaining comfortable room temperature. Noted for their many years of dependable operation without repairs.

UTMOST COMFORT and EFFICIENCY of STUDENTS and TEACHERS is assured in POWERS controlled schools. Because Powers control requires so little attention, operating personnel can devote more time to other duties. Many schools report 25 to 40 Years of Dependable Operation with astonishingly low operating cost. With today's higher heating cost, Fuel Savings gained by Powers prevention of OVER-heating, are larger than ever before.



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. . . eliminate packing maintenance, leakage of water, steam or loss of vacuum. Made in a variety of styles and sizes for all requirements. Now standard with Powers Control systems.

METAFLOW Control Valve

When you want automatic temperature control with the important advantages cited above . . . install POWERS. No other system gives so many years of dependable service at such low cost.

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OVER 60 YEARS OF AUTOMATIC TEMPERATURE CONTROL

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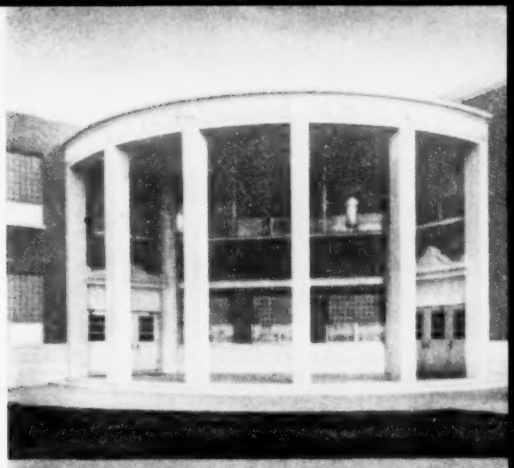
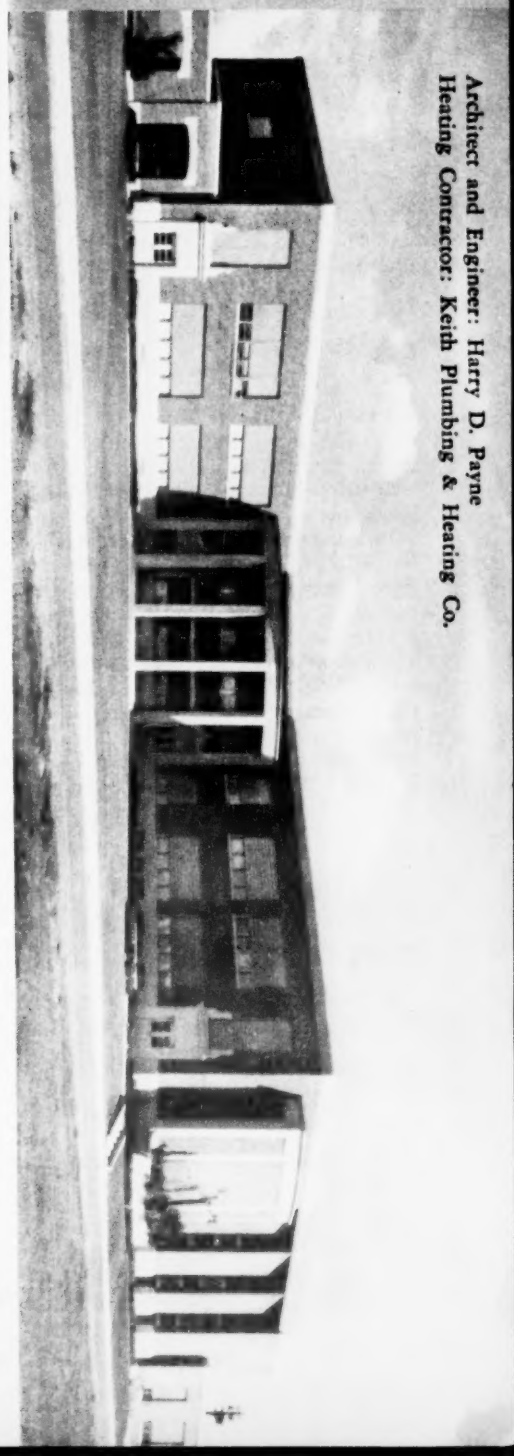
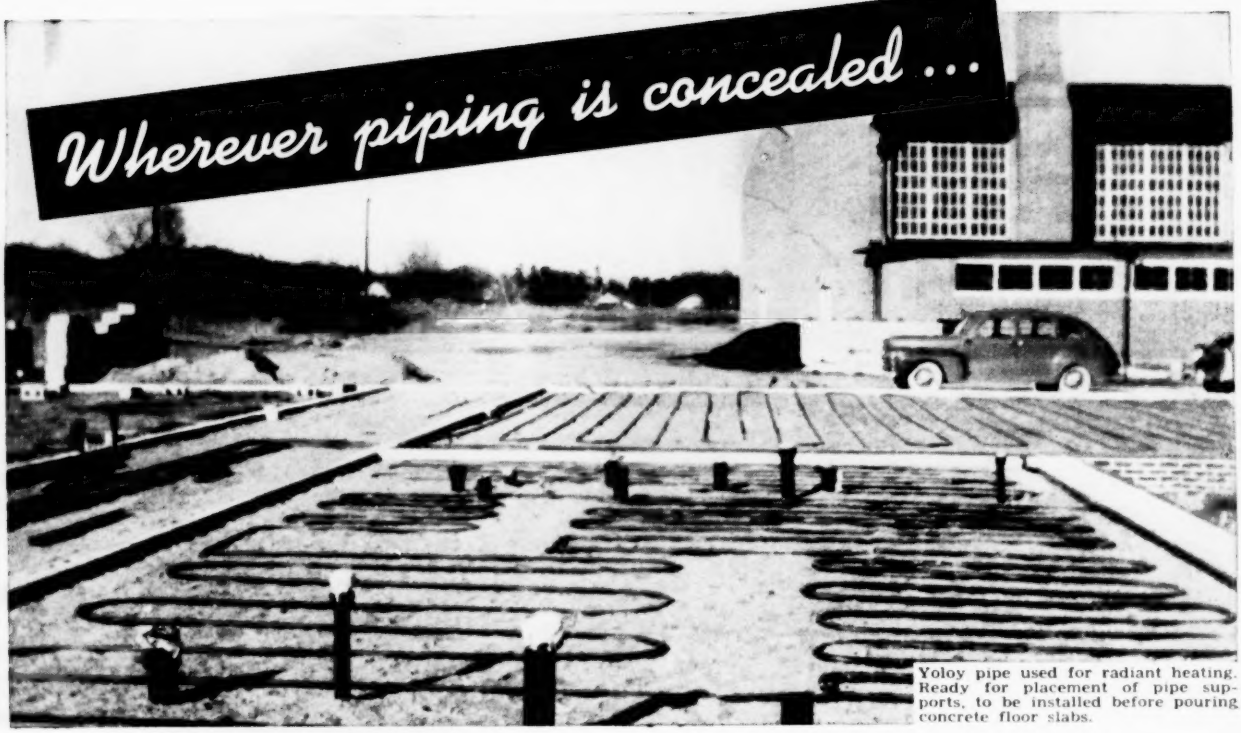


DEER PARK, TEXAS, HIGH SCHOOL



Architect and Engineer: Harry D. Payne
Heating Contractor: Keith Plumbing & Heating Co.

Wherever piping is concealed . . .



Yoloy pipe used for radiant heating. Ready for placement of pipe supports, to be installed before pouring concrete floor slabs.

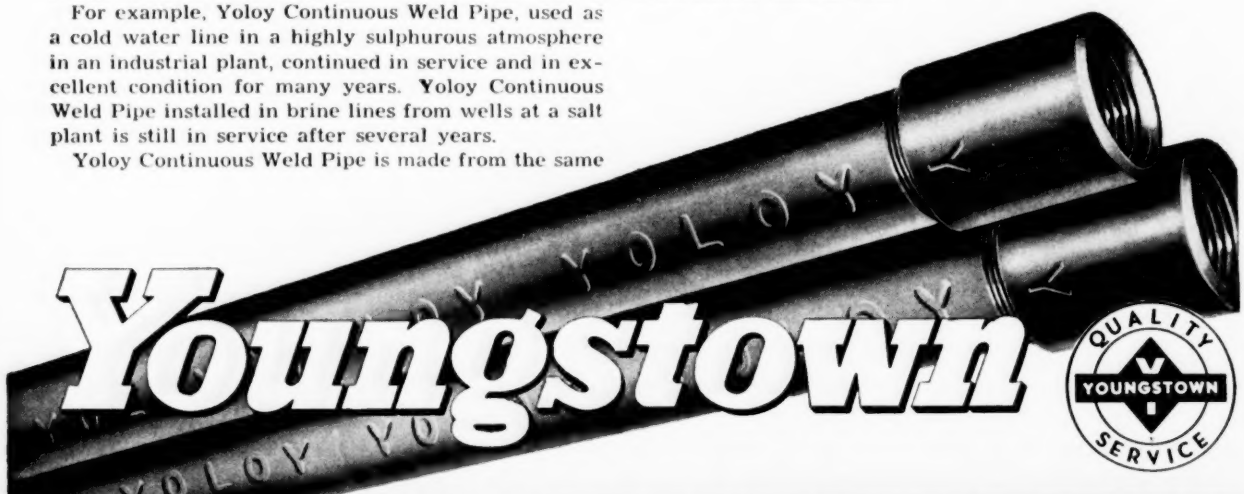
use YOLOY *continuous weld pipe*

Yoloy Continuous Weld Pipe offers distinct advantages for radiant heating and snow removal. Its use is recommended whenever piping is concealed—in industrial plants, commercial buildings, hospitals, schools and residences.

In standard tests Yoloy steel has demonstrated that its resistance to atmospheric corrosion is four to six times greater than that of regular steels. In actual installations Yoloy Pipe has demonstrated that it has a high resistance to many other corrosive conditions.

For example, Yoloy Continuous Weld Pipe, used as a cold water line in a highly sulphurous atmosphere in an industrial plant, continued in service and in excellent condition for many years. Yoloy Continuous Weld Pipe installed in brine lines from wells at a salt plant is still in service after several years.

Yoloy Continuous Weld Pipe is made from the same nickel-copper steel composition that has proved so successful in service in the oil, mining, railroad, chemical, trucking and other industries where resistance to corrosion and abrasion is of prime importance. This pipe is easy to thread and fabricate with standard pipe tools. It can be electric or gas welded readily. It has high strength and high resistance to abrasion, shock and vibration fatigue. For further information, write or phone the Youngstown District Sales Office nearest you.



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WHEN YOU SEE THE GOOD WILL you gain—when you make Dorex Air Recovery part of your air conditioning and ventilating installations—you'll be thankful indeed. Every $100 your clients invest in Dorex Air Recovery should save them about $400 on original equipment; and every $1 spent for Dorex maintenance over the years should lop about $4 off operating costs. The reason is simple—

Dorex Air Recovery "manufactures" *fresh* air by taking the odors and gaseous impurities out of *used* air. So there is far less outside air to heat or cool. But savings aside, Dorex Air Recovery is well worth while merely for its ability to maintain air freshness and abate odor nuisances common to many manufacturing processes.

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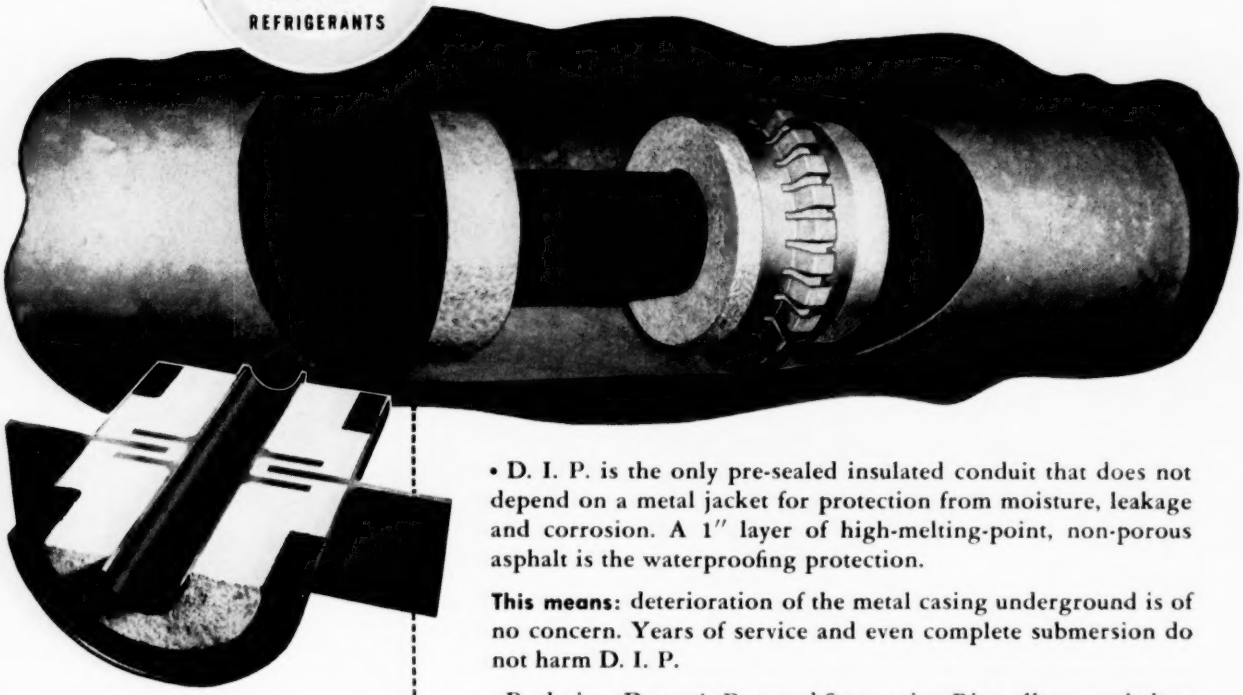
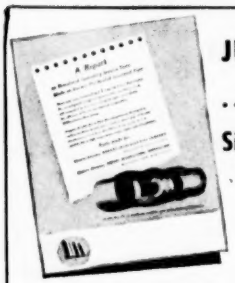
FIRST IN THE FIELD OF PRE-SEALED INSULATED PIPING FOR STEAM HOT WATER REFRIGERANTS

Only DURANT Pre-sealed Insulated Pipe gives you these features:



Durant Patented Insulated Anchor



JUST OFF PRESS

...A Report on Simulated Operating Service Tests Made on D.I.P.

This 6 page bulletin contains a detailed report on methods, temperature recordings and results of recent tests made by an independent engineering firm to determine (1) temperatures developed in and near D.I.P. conduit buried 48" underground, and (2) effects, if any, on D.I.P. due to high temperature and water-soaked insulation.

May we have your address so we can mail you a copy ?

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PRE SEALED

- D. I. P. is the only pre-sealed insulated conduit that does not depend on a metal jacket for protection from moisture, leakage and corrosion. A 1" layer of high-melting-point, non-porous asphalt is the waterproofing protection.

This means: deterioration of the metal casing underground is of no concern. Years of service and even complete submersion do not harm D. I. P.

- By design, Durant's Patented Supporting Ring allows asphalt to flow through openings during fabrication to *encase* the ring.

This means: water or moisture cannot pass through support points to the insulation or pipe. It means efficient insulating properties and extreme durability.

- Durant's Patented Insulated Anchor eliminates contact between anchor plate and pipe.

This means: reduced heat loss and elimination of corrosive electrolytic action at anchor points.

Many other advantages come with D. I. P.—such as low cost installation, for the Durant field joint can be made swiftly and easily. D. I. P. does not require external casing-welding: nor does it require concrete tunnels, slabs, rollers, supports, drains or additional protection for superimposed loads—such as under roadways or railroad tracks. Steam pressures to 1000 psi.

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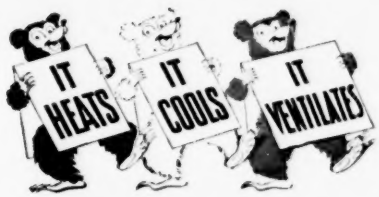
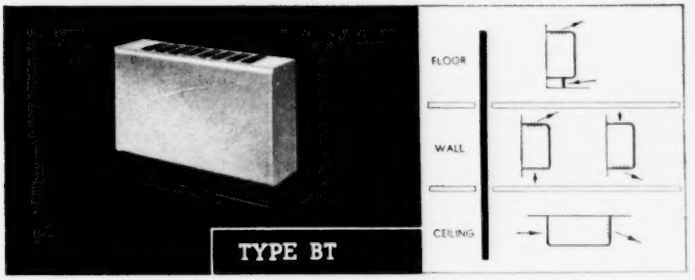
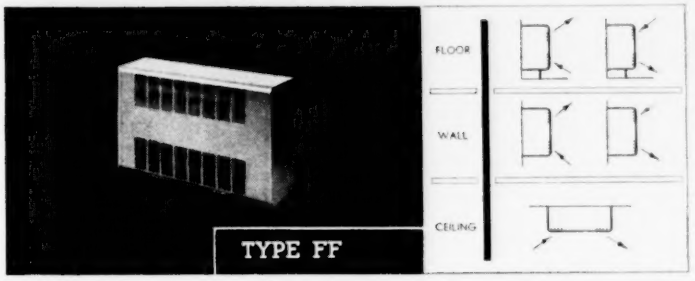
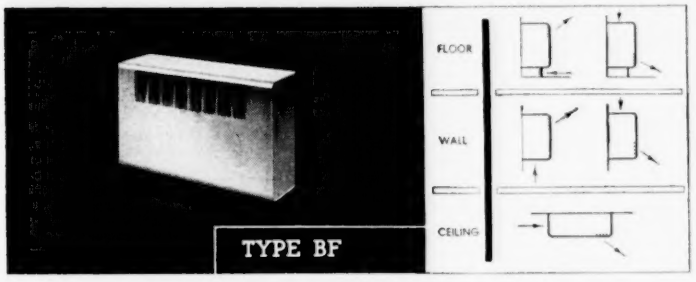


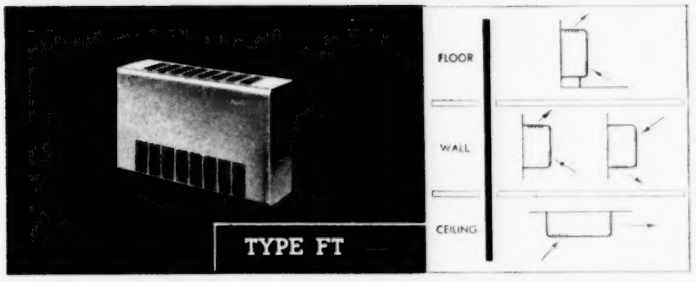
TOPS in VERSATILITY

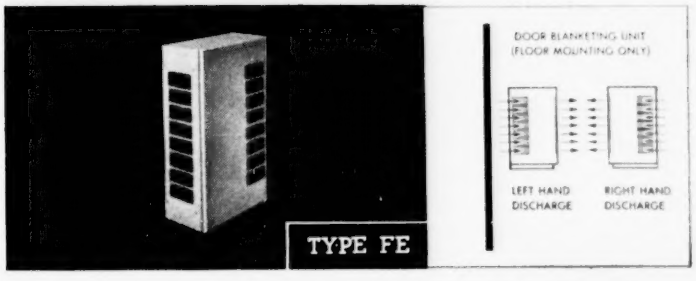
Modine Cabinet Unit provides year 'round comfort for any building











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Some are for steam or hot water heating only. With others you can heat — or cool with chilled water. Inexpensive accessories permit ventilating with fresh outside air.

Mounted on floor, wall or ceiling, they provide quick, positive, quiet heat distribution. Ideal for concealed installation with ducts. And they're economical—cost considerably less to install than individual unit ventilators or air conditioners.

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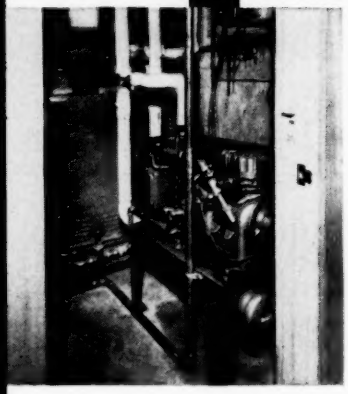
by Acme FLOW-COLD®



The Flow-Cold Liquid Chiller fits conveniently in a hall closet to provide a central cooling plant for the whole house.

A central air conditioning plant that fits snugly into a hall closet is just one of the many outstanding design features of this functional modern home located in Dallas, Texas. Selected for its compact size, quiet and efficient operation was the Acme Flow-Cold Packaged Liquid Chiller. Design conditions called for the unit to cool 15 GPM of water from 53 degrees to 45 degrees, thus handling a load of 5 tons. By keeping this 3-bedroom ranch type home comfortable in the hottest Texas weather, the Acme Flow-Cold has proved the wise choice of consulting engineer, Mr. Herman Blum, and the efficient installation of the Beard Plumbing Co.

The Flow-Cold Packaged Chiller was installed in conjunction with a hot water boiler and circulates chilled water in the summer and hot water in winter, with convectors in each room for year-round air conditioning. Versatile, easily installed and pre-tested at the factory, the Acme Flow-Cold can be used effectively by you in your next job — whether you are designing or building homes.

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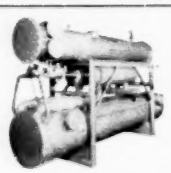

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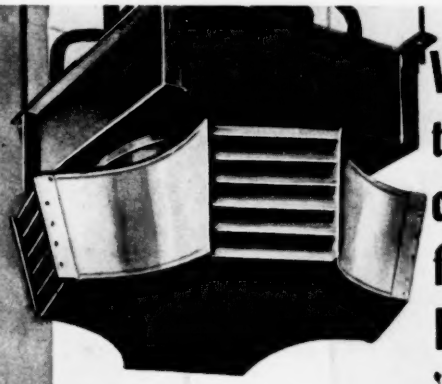

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HERE'S how to keep workers happy, and production at peak all through the hot summer days. Just turn off the steam in your Wing Revolving Unit Heaters, and turn on the fans and revolving discharge outlets. **You will be amazed at the results!!**

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WING Draft Inducers insure positive, adequate, uniform draft regardless of variable weather conditions or inadequate chimney or breeching construction.

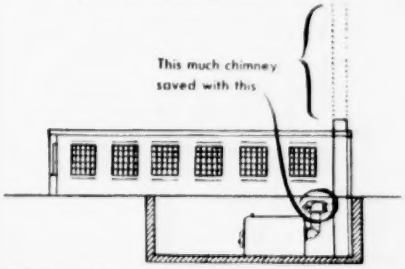

Diagram above shows how much chimney is saved by installing Wing Draft Inducers.

Wing Draft Inducers are suitable for use in connection with oil, gas, stoker-fired or hand-fired heating boilers, industrial furnaces or kilns, or high pressure steam boilers, either stationary or marine. Sizes are available for boilers as low as 1000 sq. ft. E. D. R. up to steam generators producing 100,000 pounds of steam/hr. Special, heavy duty designs available for these larger boilers.

Wing Draft Inducers are made in two types—for insertion in breeching or flue, or for installation on top of a chimney. Write for a copy of Bulletin I-52 to L. J. Wing Mfg. Co., 158 Vreeland Mills Road, Linden, New Jersey.

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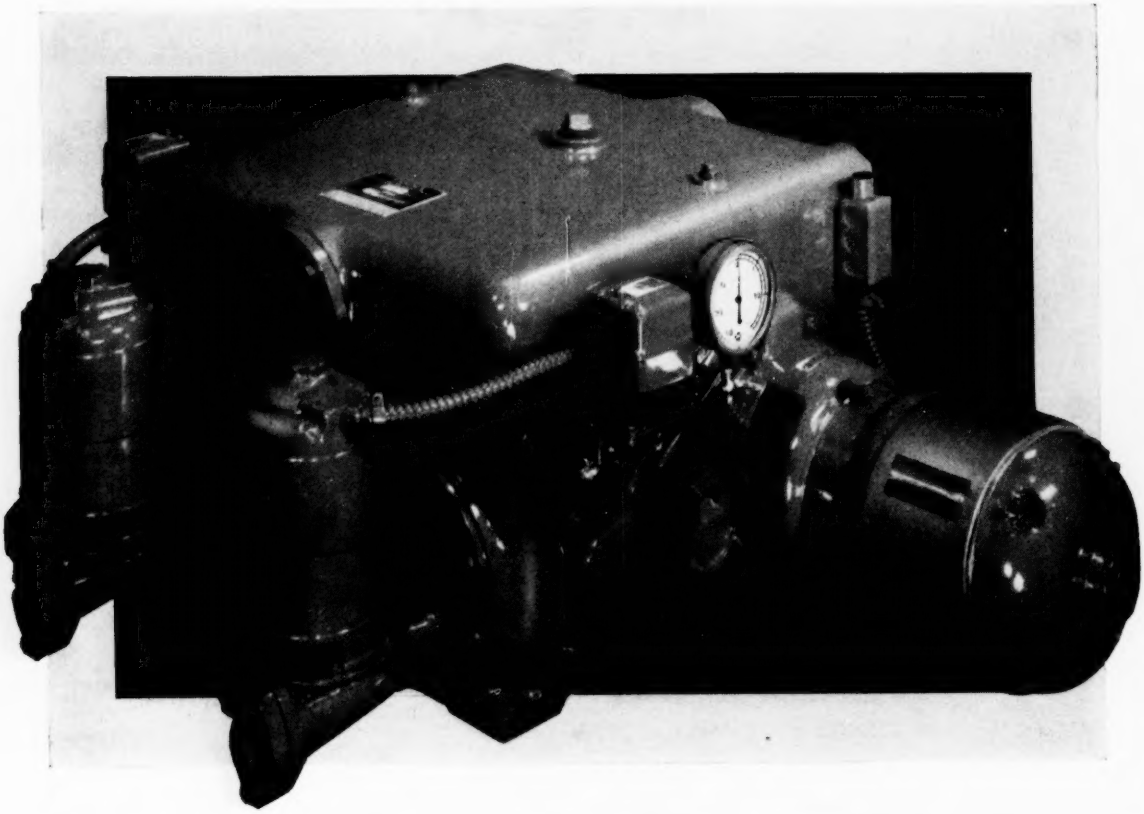
HAS THE INCREASED AIR CAPACITY EFFICIENT HEATING PRACTICE DEMANDS



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Designed and manufactured by the organization that made the Jennings Manifold Heating Pump standard of the Heating Industry, the new CSM incorporates every desirable feature architects, engineers, owners and operators have sought. Employing separate air and water pump elements, each with its own motor and each independently controlled by its own automatic switch, the capacities and arrangement may be widely varied to meet job conditions. For the first time, the engineer has the choice of realistic water and air capacities required for rapid system response without wasteful overheating.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

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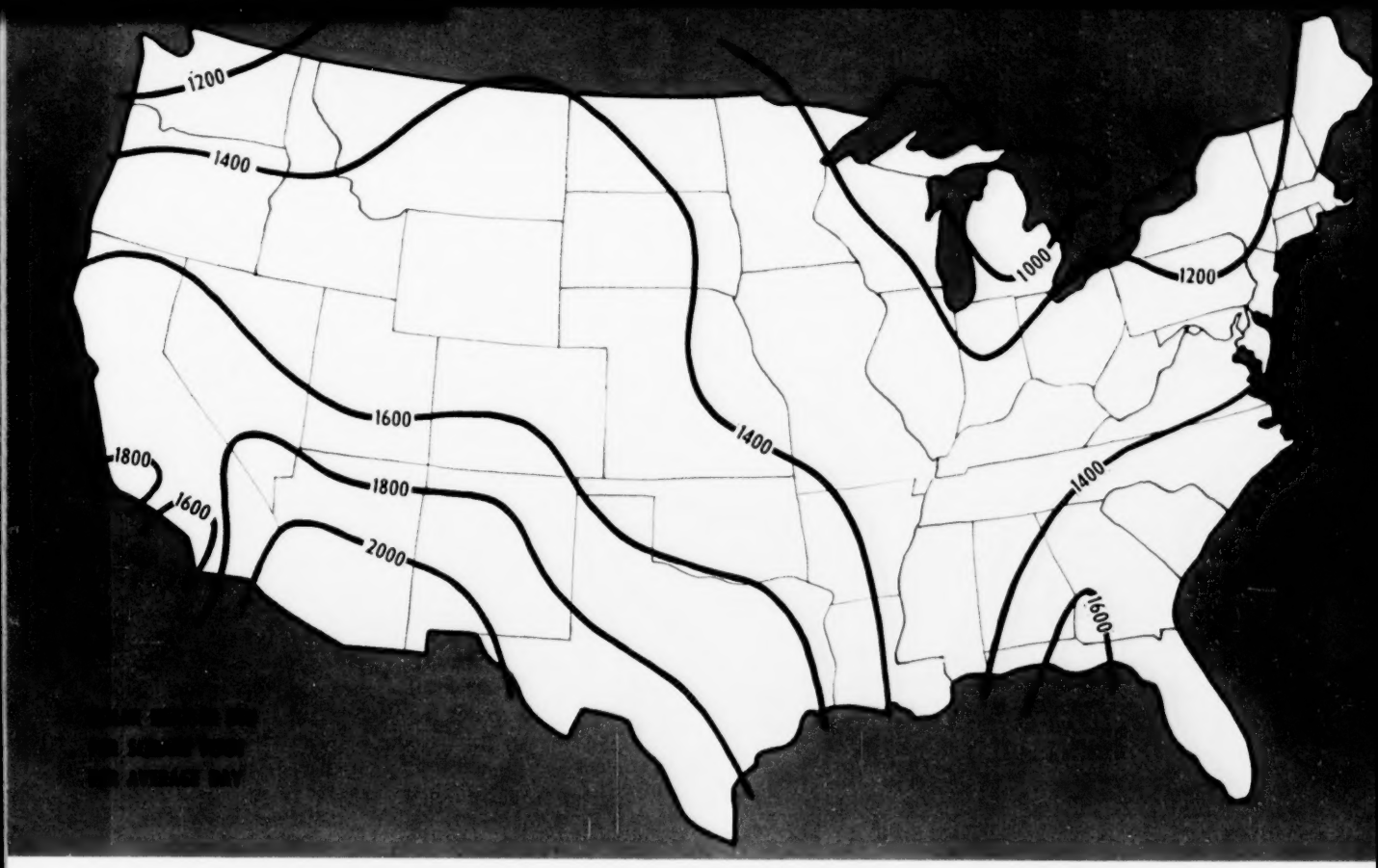

Distribution of Solar Energy Over the United States

I. F. HAND

U. S. Weather Bureau, Blue Hill Observatory, Milton, Mass.

Values of solar energy received on a horizontal surface, during the last forty years, throughout the United States have been assembled and some of the data correlated with other meteorological elements. Use of this condensed data should be helpful to engineers.

RADIATION from the sun is the ultimate source of all except a practically negligible portion of the continual supply of energy that is essential for the maintenance of plant and animal life on earth. The study of the solar energy received from the sun is therefore of direct and fundamental importance to numerous different fields of both pure and applied science, including meteorology.

While all of us appreciate the sun, few realize its full role. For example, the receipt of solar energy at El Paso, Texas, exceeds 2 x 10^{13} Btu per square mile per year, while the amount received over continental United States annually exceeds 3 x 10^{18} Btu. This is equivalent to the Btu contained in 700,000 tons of the best anthracite coal.

The Eppley pyrheliometer (1)* has been adopted by the Weather Bureau as its standard receiving instrument. The majority of recorders are either Leeds and Northrup micromax or Brown Electronik potentiometers. In a few instances, integrating recorders are used, thereby saving considerable time by eliminating the necessity of evaluating the records by eye, but this type instrument gives daily totals only.

The Weather Bureau first began studies of solar energy in 1901 (2). At the present time, solar data from more than 70 stations in continental United States, Canada, and outlying areas from the equator to within ten degrees of the North Pole appear regularly in the Weather Bureau publication, "Climatological Data, National Summary."

*Numbers in parenthesis refer to the bibliography at end of article.

I. F. Hand, who attended Union College, Schenectady, N. Y., entered the government service at Mount Weather, Va., in 1912 and two years later transferred to the Solar Radiation Investigation section of the Weather Bureau at Washington, D. C. At present, he is in charge of the United States Weather Bureau Solar Radiation Observatory at Blue Hill, Milton, Mass.

The increasing interest in attempts to put solar energy to practical use has prompted preparation of normals of solar energy at selected stations where sufficient data have been obtained. Fritz and MacDonald presented a thorough treatment of the average radiation received in the United States (3), in 1949, using data from 11 stations. In addition to monthly isolines, they expressed the relationship of total solar and sky radiation received on a horizontal surface, to cloudless days' radiation and percentage of possible sunshine as a linear equation. Fritz (4), Kimball (5), Angström (6), and Haurwitz (7) have treated solar data in a somewhat different manner.

Forty-nine stations from selected stations where sufficient data are available have been used in this paper. In cases where the records are of short duration, but otherwise trustworthy, less weight has been given them in the preparation of the chart when drawing the isolines.

Ordinarily, values of solar energy are expressed in langleys, but here we converted langley values to British thermal units per square foot, a unit which is used by heating and many other engineers.

All values represent the amount of solar energy received on a horizontal surface from the sun and sky. Values of diffuse energy received from the sky (8), energy from the sun at normal incidence, and of the energy received on vertical surfaces facing the cardinal points have been and now are being made at the Weather Bureau Office, Blue Hill Observatory, Milton, Mass.

Table 1 lists normals of the daily receipt of solar energy on a horizontal surface for the months of June and December and for the entire year. The map has lines of equal receipt of solar energy for the year.

Table 2 shows the relationship between the annual receipt of solar energy and the following: (1) the number of hours of sunshine; (2) the average cloudiness; (3) the number of clear days, and; (4) the percentage of daylight hours that the sun shines. The data used in these four items were taken from U. S. Weather Bureau Technical Paper No. 12. The individual groups represent the areas between lines of equal energy receipt. The second part of Table 2 was prepared for the period October through March, inclusive, in a similar manner. Inasmuch as one of the chief purposes of this paper is to show how solar energy is available during the heating season, the summer data have not been separated into groups.

We would be greatly surprised if no relationship appeared between receipt of solar energy and both sunshine and cloudiness. However, in order to insure comparable

TABLE 1—RECEIPT OF SOLAR ENERGY AS IT VARIES WITH LATITUDE

City	N. Latitude		Average Btu per Sq Ft per Day		
	Deg.	Min.	June	December	Year
Miami, Fla.	25	49	1771	1085	1497
Brownsville, Tex.	25	55	2590	1192	1840
Gainesville, Tex.	29	39	1904	841	1471
Apalachicolas, Fla.	29	45	2192	959	1675
New Orleans, La.	30	02	1697	804	1250
Lake Charles, La.	30	13	2151	819	1568
El Paso, Tex.	31	48	2731	1207	2037
Fort Worth, Tex.	32	49	2332	867	1699
La Jolla, Calif.	32	52	2066	904	1526
Charleston, S. C.	32	54	2166	786	1575
Griffin, Ga.	33	14	2273	738	1578
Riverside, Calif.	33	32	2207	782	1558
Santa Maria, Calif.	34	56	2399	867	1817
Albuquerque, N. M.	35	03	2749	1085	1892
Hatteras, N. C.	35	15	2266	756	1594
Oak Ridge, Tenn.	35	55	2000	598	1307
Las Vegas, Nev.	36	05	2771	845	1822
Nashville, Tenn.	36	07	1934	465	1253
Stillwater, Okla.	36	08	2196	775	1467
Fresno, Calif.	36	46	2642	605	1670
Davis, Calif.	38	32	2642	576	1633
Washington, D. C.	38	56	1867	539	1234
Columbia, Mo.	38	57	2077	664	1388
Seabrook, N. J.	39	30	2007	535	1316
Grand Lake, Col.	40	15	2362	613	1573
Salt Lake City, Utah	40	46	2192	443	1442
New York, N. Y.	40	46	1646	395	1054
Sayville, N. Y.	40	46	2066	498	1291
State College, Pa.	40	48	1845	424	1154
Lincoln, Neb.	40	52	2052	613	1354
Upton, N. Y.	40	52	2081	487	1269
Cleveland, Ohio	41	24	2214	406	1312
Newport, R. I.	41	30	1963	524	1258
Put-in-Bay, Ohio	41	39	2092	399	1242
East Wareham, Mass.	41	46	1897	542	1204
Blue Hill, Mass.	42	13	1911	498	1243
Boston, Mass.	42	21	1823	406	1110
Medford, Ore.	42	22	2590	362	1575
Ithaca, N. Y.	42	27	1867	391	1119
Twin Falls, Ida.	42	33	2303	450	1438
East Lansing, Mich.	42	42	1638	343	998
Madison, Wis.	43	05	1904	443	1218
Toronto, Ont., Can.	43	40	1926	347	1078
St. Cloud, Minn.	45	35	2066	561	1352
Caribou, Me.	46	52	1963	391	1227
Spokane, Wash.	47	37	2269	280	1374
Seattle, Wash.	47	39	2280	229	1160
Glasgow, Mont.	48	11	2494	450	1455
Winnipeg, Man., Can.	49	53	2048	365	1216

TABLE 2—SOLAR ENERGY, HOURS OF SUNSHINE, CLOUDINESS, AND PERCENTAGE OF DAYLIGHT HOURS THAT THE SUN SHINES

Btu per Sq Ft	Hours of Sunshine	Average Cloudiness: Scale, 1-10	Clear Days, 0-3 Cloudiness	Percentage of Daylight Hours that the Sun Shines
		Year		
Less than 1000	2177	6.6	86	48
1001-1200	2339	6.2	93	51
1201-1400	2643	5.5	123	58
1401-1600	2826	5.1	134	63
1601-1800	3055	4.6	166	68
1801-2000	3145	4.4	179	71
More than 2000	3776	2.6	246	84
	October Through March, Inclusive			
201-400	82	7.6	4.1	29
401-600	118	6.8	6.6	41
601-800	150	5.8	9.3	49
801-1000	171	5.3	11.1	55
1001-1200	197	5.1	11.7	59
1201-1400	211	4.8	12.1	64
1401-1600	242	4.7	13.3	68
1601-1800	245	4.4	14.4	72
1801-2000	271	4.2	16.0	73

results, we included only those stations where sunshine and cloudiness data are available and these stations greatly outnumber the stations where solar energy is measured. It must be realized that any chart showing the distribution of solar energy over the country treats large areas only and that individual stations might vary as much as 100% or more from surrounding areas. Also, summer data show large variations owing to a number of factors, chiefly differences in topography. For example, proximity to large water surfaces with a higher percentage of foggy days, location on the windward side of mountains with its higher than average percentage of cloudiness, areas of profuse vegetation with high rate of evaporation, and desert conditions with intense convection—all have an effect on solar receipt. An excellent example of large variation in solar receipt within a few miles is shown by data from La Jolla and Torrey Pines, California. Although these stations are only ten miles apart, La Jolla is directly on the Pacific shore, while Torrey Pines is seven miles inland on a high bluff. During some of the spring months the solar receipt at Torrey Pines is considerably more than that received at La Jolla, owing to frequent fog at the shore station.

Severely contaminated atmosphere occasioned by smoke results in large losses of solar energy (9). In general, the solar receipt at Pittsburgh, New York, Chicago, Boston, Salt Lake City, St. Louis, and other manufacturing centers suffers a loss of at least 10%, owing to atmospheric pollution. Data from stations influenced markedly by local contamination have not been used in either the preparation of the illustration or Table 1.

The average amount of solar energy received in December at Seattle is less than 20% of that received at El Paso during the same period. In addition to the latitude effect, the high percentage of cloudiness, fog, and precipitation in the extreme northwest are responsible for these low values, while almost continuous sunshine prevails in the arid Southwest. The annual receipt of solar energy in the Southwest is twice that received in the Great Lakes region. The high percentage of cloudiness caused by the moisture from the Great Lakes is responsible for the low values near them. New Orleans, in the Mississippi delta, an area of relatively high thunderstorm activity, has low values owing again to excessive cloudiness. The far Northwest ranks second to the Great Lakes region in percentage of cloudiness, while the Mississippi delta ranks third.

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Window Units Selected for Office Building

A total of 750 individual room cooling units of the window type will be used to air condition the 42-story Gulf Building in Pittsburgh, Pa. This $225,000 order placed with Philco Corp. is claimed by the company to be the largest order ever placed for window type room cooling units.

Design of units was developed by engineers of Gulf's research and engineering departments working with Philco. These units will rest on window sills and will extend into the rooms instead of projecting outward. There will be no extension of the unit beyond the glass line. At present, 150 of the units have already been installed and the remaining 600 will be ready by October.

Eighty-two per cent of the space in the Gulf Building will be air conditioned. This is the entire portion of the building to be occupied by Gulf Oil Corp. With the moving of Aluminum Company of America offices to the Alcoa structure, Gulf has arranged to take over this space for company offices.

A number of reasons influenced the decision to use window cooling units instead of installing a central air conditioning system. No ducts were installed when the Gulf Building was erected so that if a central air conditioning system was selected, it would be necessary to install a large amount of ductwork. Estimated cost of a central air conditioning system, plus the necessary ductwork and piping was between one and two million dollars.

In addition, the water requirements for a central system was computed at 500 tons daily or at an approximate daily cost of $420. Building design and conditions make it impossible to install an evaporative condenser or cooling tower. It is said that the use of a central air conditioning system would have required the use of two of the building's elevator shafts.

Another factor which the purchaser considered is that each office can choose its desired temperature and can regulate the cooling to suit individual needs. Should there be a failure of mechanical equipment, an entire building is not affected.

The air conditioning of existing buildings is a problem as in many cases there are not the proper facilities and space requirements for easy design.

Air Conditioning for Residences Designed for Low Cost

J. F. SANDFORT

Associate Professor, Department of Mechanical Engineering, Iowa State College of Agriculture and Mechanic Arts, Ames, Ia.

Two-zone air conditioning system for a residence with central station equipment, resulted in flexibility of operation and a considerable saving in cost as compared with a packaged system.

FOR many years summer air conditioning has been accepted and has become common-place in American life. We expect our shops, stores, theaters, and restaurants to be comfortably cooled during hot weather. Gradually too, the long predicted development of the large residential air conditioning market seems to be materializing.

The great promotional effort behind this development is directed toward packaged self-contained equipment, produced in a few standardized sizes. This raises the question as to whether residential air conditioning should always be purchased as a package, in the same manner as you would buy a television set or a hot water heater Is it possible to over-simplify and over-standardize these systems with the result sometimes of having inflexible and misfit equipment? This is not conducive to maximum consumer satisfaction and may actually result in a higher owner cost, the very thing that standardization is supposed to prevent.

For the manufacturer and his distributing organization, the self-contained packaged room cooler has much in its favor. Its compact size makes it ideal for handling and merchandising. A minimum of engineering service is required in its application and installation expense is usually low. No one can deny that the manufacture of room coolers will continue to be a very important segment of the air conditioning industry, particularly in its application to existing houses, apartments, and similar buildings.

However, we must recognize that the year-round central air handling system has much to offer in versatility and flexibility and is often the preferred engineering solution, especially in new residential construction. Central systems are being offered in packaged units, usually in combination with gas-fired furnaces. When these can be fitted into the heating and cooling requirements of a house, they may be used to advantage. Where the design requirements cannot be satisfactorily met with these units it is a relatively simple matter to adapt condensing units and evaporators to standard sizes and units of warm air furnaces.

As the manufacturing volume of this air conditioning equipment has increased, costs have been somewhat lowered, but the fundamentals of the problem are such that we can always expect to pay considerably more to cool buildings than to heat them, at least so long as we have adequate reserves of natural fuels available. As a result, it is probable that there will always be a large marginal residential air conditioning market where it is not economically feasible to air condition an entire house to the same extent that it is heated, but where summer cooling is desired nevertheless. A room-cooler or two might be the best answer but often the use of some engineering ingenuity in application of a central system will make possible a much better solution.

Architects emphasize the desirability of designing homes so that the bedroom wing of the house is isolated from the living quarters, and many homes are designed to incorporate this idea. This usually provides an opportunity for arranging the duct system in such a way

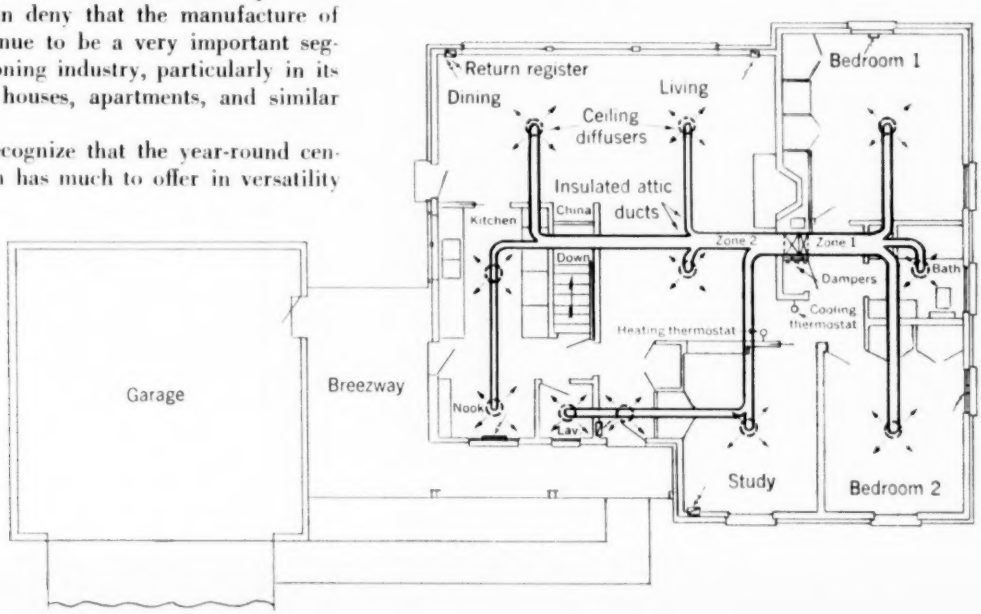


Fig. 1. First floor plan showing the layout of ducts and location of ceiling diffusers.

that the bedroom wing and the living quarters are separated into two zones. With such a plan it is possible to use a small condensing unit with only enough cooling capacity to handle half of the house at a time. This is satisfactory since the bedroom zone can be shut off during the day when no cooling is required. During the night, the entire cooling capacity can be diverted to the bedrooms while the rest of the house can be shut off the cooling system.

An additional benefit of the central system might be the effective control of high humidities in basements during the summer months. A common complaint heard in many parts of the country comes from people who cannot effectively use their basements during certain periods of the year because the high humidity causes tools and other equipment to rust, and clothes and furniture to become damaged from mold and mildew. High humidities in basements are usually caused by a combination of high outside dew point and cold ground temperatures during the spring and summer. About the only effective way to control this humidity is to remove water vapor continuously at the same rate that it is infiltrating into the basement. Ordinary air conditioning equipment responding to thermostatic control is usually not indicated for this service since the basement dry bulb temperature is already relatively low, and sensible cooling is not required. Instead, special purpose dehumidifying units have been developed which use either refrigerating cycles or sorbents, and are so designed as to remove only latent heat from the air.

However, where air conditioning is planned, the refrigeration equipment is available for basement dehumidification, if only some way could be found to adapt it for this use. This could be done by so arranging the duct system that the dry air from the conditioned areas could be circulated through the basement during the cooling cycle. Suitable controls would have to be installed to coordinate the various operating functions, but the net result would be an extremely versatile year-round air conditioning system at a surprisingly low cost.

Following is a detailed description of how one such system was designed, together with some operating results and comparative cost data.

Details of House and System

The house, a one-floor modified ranch design with two bedrooms and a study, 1 and ½ baths, a kitchen and eating nook, and a living-room combined with a dining room, is shown in Fig. 1. The floor area is about 1,350 sq ft. A full basement contains a shop, recreation room, and a utility area. The house is well weatherstripped and permanent storm windows were installed. Three 6 ft x 6 ft double-glazed picture windows face the south. The walls and ceilings are insulated with one inch and two-inch blankets respectively, both using vapor barriers.

Both heating and air conditioning were desired. The design heating load was calculated to be 76,600 Btu per hour, and the total cooling load was calculated to be about 30,000 Btu per hour. After a preliminary cost study of the various possible systems, it was decided to use a central system with a gas-fired furnace, and a small condensing unit capable of cooling only one zone at a time in the manner outlined. Basement dehumidification was also desired.

Prof. Sandfort received BME and BIE degrees from Ohio State University in 1934 and his MS from Iowa State College. For four years he was with the Frigidaire and Delco-Frigidaire Divisions of General Motors Corp., and during four years of World War II served with the U. S. Field Artillery in both the European and Asiatic-Pacific theaters. Following his military service, he affiliated with Iowa State College, specializing in heating, air conditioning and refrigeration. He is a member of ASHVE.

An overhead distribution system using ceiling diffusers was specified for the following reasons. Such a system would be ideal for continuous air circulation without drafts for both summer cooling and winter heating. It greatly simplified air distribution problems in the occupied space, and it permitted a perfectly clear ceiling in the recreation room and shop. The problem of warm floors in winter was not a factor since the basement was to be heated.

When the duct system is placed in an attic space, heavy insulation is of course required for satisfactory performance and economical operation. One method which is sometimes used consists of wrapping the ducts with insulating blankets. This, however, has certain disadvantages for it is difficult to get a thorough job of insulation. It is frequently impossible to get under the ducts, and fitting the insulation around the ceiling diffuser connection is quite a problem. A cheaper and more satisfactory arrangement is to simply box in the system with some retaining walls and then to surround the ducts with a fill insulation such as rock wool or vermiculite. This method also makes it more practical to use thicker insulating layers. An average of four inches was used in the system described, and subsequent tests have shown that this was a wise investment. In this connection, it is important to remember that when air conditioning ducts go through areas where the duct surface temperature is below the ambient dew point temperature, a vapor barrier over the insulation is necessary if condensation is to be avoided. In this case we must concede that wrapped ducts would have the advantage. However, with the operating method described, it was not found necessary to use vapor barriers. This point is more fully explained later.

It was decided to divide the house into two first floor zones to permit the utilization of a small condensing unit with a necessary capacity for handling only one zone at a time. Bedrooms 1 and 2 and the bathroom were on zone 1, while the balance of the first floor was on zone 2. See Fig. 1. Volume dampers were placed in the main riser to the attic and operating handles were made accessible from a first floor closet for the convenient shifting from one zone to the other. An analysis of the cooling load showed that zone 2 could be adequately handled by a 1½ hp, water-cooled, condensing unit, with sufficient reserve capacity to perform basement dehumidification. When used with zone 1, this unit would have an excess cooling capacity, but this was desirable since a rapid pickup was necessary when the air conditioning was turned into the warm bedrooms in the evening.

If any duct system is to serve satisfactory for both winter heating and summer cooling as described, as well as for basement dehumidification, a rather unique method

of handling the return air and integration of the control system is required. A general discussion of the problem and the recommended solution follow.

Residential basements in general have floor and wall temperatures below the inside design dry bulb temperatures, but with dew points approaching that of the outside air. Thus on a day when the outside conditions are 95F dry bulb, 72F dew point, and 46% relative humidity, we might find basement air at 80F dry bulb, 72F dew point, and 75% relative humidity, and the basement floor and walls close to or even below the dew point. Now with the upstairs air conditioned to 80F dry bulb, 60F dew point, and 50% relative humidity, we have the opportunity of dehumidifying the basement by returning this upstairs air through it, thus diluting the 72F dew point air with the dryer 60F dew point air from the conditioned space. The resulting steady flow conditions for the basement air would be 80F dry bulb with a relative humidity somewhere between 75% and 50% depending upon the amount of outside air infiltrating into the basement. Operating in this manner there would be no additional sensible cooling load added to the compressor, and as a matter of fact, during certain periods of operation there would actually be a reduction of total air conditioning load due to the cooling effect of the basement walls and floor.

To accomplish this result then we must continuously circulate the return air through the length of the basement regardless of which zone is being cooled upstairs. This can be done by installing dampers in the return ducts at the plenum, and providing registers which open into the basement at the opposite end of the return system. During summer cooling then, no supply air would be sent directly to the basement. The return registers would be opened only in the one zone being cooled, and all the return air would flow in a reverse direction through the return ducts, and enter the basement at the end opposite to the furnace, Fig. 2. This relatively dry air would then pass through the basement and enter the air conditioning unit at some central opening. Operating in this manner the basement dew point would always be somewhat higher than that in the upstairs zone being cooled, but the relative humidity could be controlled at a point well below that where it would be damaging or uncomfortable. Tests have shown this to be true.

The control of this system for summer cooling would be as follows. A cooling thermostat would be located in each zone and a humidistat placed in the basement. All would be connected in parallel so that any one could start the compressor motor upon demand. The blower should operate continuously to keep the air circulating through the basement, even when the condensing unit is not running. This accomplishes two things; (1) it prevents a rapid buildup of relative humidity in the basement, and (2) it supplies a certain amount of sensible cooling by transferring heat from the upstair zones to the basement walls and floor.

With this method of control, the question arises as to what happens when the humidistat is calling for dehumidification but both thermostats are satisfied. The compressor of course would run and the affected zones would be cooled below their thermostat settings. To minimize this operating condition, the basement humidistat should be set as high as possible while still accomplishing the objective of basement dehumidification. Under certain unusual conditions, such as drying the family laundry in the basement on a damp day, it may be necessary to use the heating thermostat as a low limit control, in which case the furnace would operate as a reheater.

In the system described it was decided to return the air in a slightly different manner than the recommended procedure. The return air ducts were shut off entirely during the cooling cycle and all of the recirculated air was returned down the basement stairs. This expedient was tried for the purpose of determining whether a single cooling thermostat, located as shown in Fig. 1, could be successfully used to control both zones 1 and 2. Returning air in this manner is generally unsatisfactory in warm air heating systems because of the drafty areas which are likely to develop. For cooling service, however, it was believed that all the air could be returned through the basement door without creating objectionable drafts in that area because of the thorough mixing of cooled air above the occupied zone in a ceiling diffuser installation, and also because of the higher draft tolerance during the cooling operation. On the basis of one summer's operation, this alternate arrangement seemed to give generally satisfactory results.

In the operation of year-round air conditioning systems, it is frequently found necessary to increase fan speeds and rebalance the duct system for summer operation. Such a procedure is not necessary with this system, since only a part of the house is being supplied with air during the cooling operation. In the system described, the ducts were designed for 1200 cfm winter

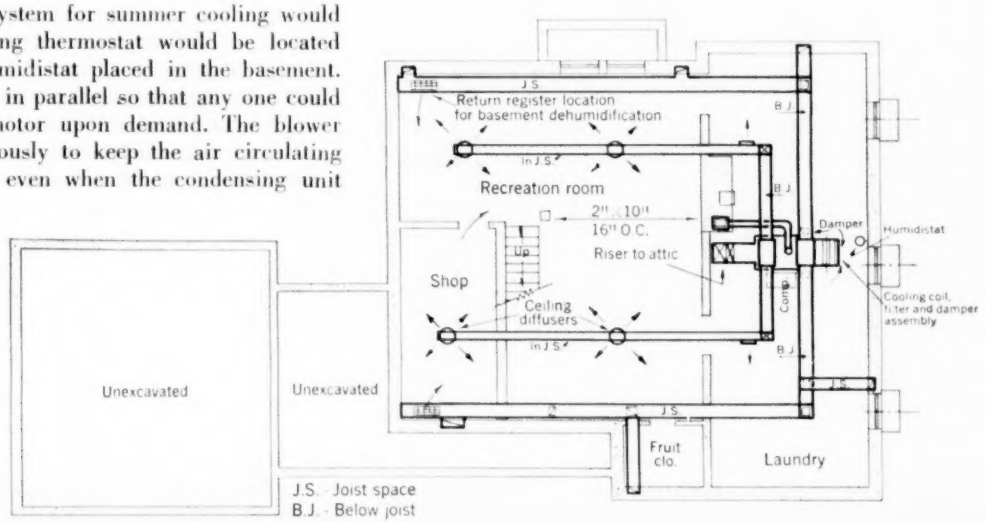


Fig. 2. Basement plan of the residence. Location of the return registers indicated.

operation. This gave about 5½ changes per hour on the first floor. In changing to summer cooling it was necessary only to remove the filters from within the furnace and place them in a bracket ahead of the cooling coil, as in Fig. 3. The increase in resistance due to sending all the air through only one zone at a time plus the addition of the cooling coil in the circuit, reduced the fan capacity somewhat below the 1200 cfm, although the air change in each zone was sharply increased. A high air change is recommended for both winter and summer operation. Drafts are not a problem with a ceiling diffuser installation.

The evaporator selected was 2 tubes deep and sized for a 300 fpm face velocity. The compressor balanced out with the evaporator at about 50F suction temperature, and this put about 66F air into the duct system. The average temperature of the air delivered to the rooms was about 70F. With air at this temperature in the ducts, dew point temperatures up to 70F and higher could be tolerated in the attic with no danger of condensation in the insulation. This is why vapor barriers were dispensed with in this design, and no evidence of condensation has ever been detected.

Some of the operating results of this year-round system were as follows:

Heating Cycle

The blower was set for continuous air circulation when the outside temperature was below 34F, and on a 34F day the following readings were taken:

Supply plenum temperature range	73F to 110F
Average temperature range behind ceiling diffusers	78F to 98F

A comparison of the temperature variation of the air in the plenum and diffuser outlets shows the extent to which a heavily insulated duct system acts as a regenerative system for damping down the temperature extremes between the cycles of a gas or oil burner. The temperature gradient between ceiling and floor was negligible (the basement was heated), and no drafts were noticed, even with the lowest entering air temperatures. Under steady flow operation, the gas furnace produced 100,000 Btu per hour at the plenum with 80% efficiency. The maximum bonnet temperature was 150F and the blower motor consumed 202 watts.

Cooling Cycle

The blower was set for continuous air circulation. The compressor operated continuously or for long on-periods during summer heat wave conditions. Continuous compressor operation was found desirable for the most effective humidity control. Under steady-flow operating conditions, the condenser used 2 gpm cooling water. The compressor and blower motors used a total of 1,700 watts.

Costs

The above system could be installed in Ames, Iowa, in the summer of 1952 for about $1800. It is interesting to compare this cost with the quoted firm bids on alternate systems.

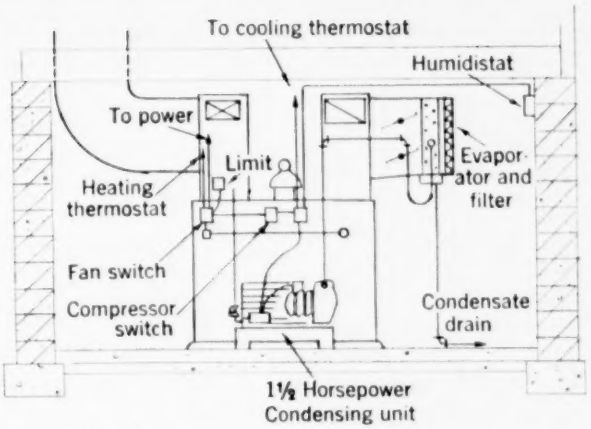


Fig. 3. Section through the furnace room.

Heating system alone, installed	$1,050
Two ¾ hp. window type room coolers, installed	798
Total installed cost	$1,848

A self-contained package unit, suitable for complete year-round air conditioning for an entire house, with a 3 hp compressor and 140,000 Btu heating section could be installed for $2,391. This price did not include the duct system, grilles, or insulation.

Summary and Conclusions

Sales figures indicate an accelerating trend in residential year-round air condition. Manufacturers are exploiting this market by concentrating on self-contained room coolers and central system package units. This has the advantage of permitting maximum standardization and a minimum of engineering application skill. However, there is a price to pay for this, in the inflexibility and performance limitations of the room cooler and the frequent inability to match cooling and heating requirements with standard central system package units. It always costs considerably more to remove a given cooling load than to supply the equivalent heating load, and a large marginal residential market would open up if the cooling load could be cut in half, but the flexibility of the central system still retained.

One method of accomplishing this is to zone the residence and then to supply refrigeration capacity for handling only one zone at a time. Manufacturers could encourage this by offering central system year-round packaged units with interchangeable condensing units down to one horsepower capacity. If properly matching package equipment is not available, small-tonnage refrigeration condensing units and evaporators can be adapted to standard furnaces. Such installations can be obtained with hermetically sealed compressors carrying a five-year service warranty and having a reliability equal to that of the package units. Furthermore, the refrigeration equipment can be added at any time after the heating system has been installed. A surprisingly large percentage of house builders are interested in this arrangement, who otherwise would reject summer air conditioning if they were forced to make definite commitments prior to actual construction.

Graphical Selector for Air Cleaners

JAMES R. KAYSE

Dust Control Products, American Air Filter Company, Inc., Louisville, Ky.

A table and graph are presented to aid anyone encountering a dust control problem to answer two questions, "What am I dealing with?" and "What do I want the collection equipment to do?" Particle size and concentration will answer the former question, and required collection efficiency the latter.

Mr. Kayse, a native of Kentucky, received his B.S. in Mechanical Engineering, Heating and Ventilating option, from the University of Kentucky in 1949. He joined the Dust Control Divison of American Air Filter Company immediately after graduation. He is a member of the American Industrial Hygiene Association, before whom he recently presented a descripton of the Sylvan chart.

THE CONCENTRATION of an aerosol in an air stream can be stated as the number, volume, mass or other property of particles contained in a unit volume of air. Concentrations of various sizes may influence the effective or design size of the particles and the selection of equipment through such factors as pluggage and maintenance of the collector. In the field of dust control, concentration is normally expressed in grains per cubic foot of gas, where 7,000 grains = 1 lb. There are three ranges of concentration for aerosols: (1) Industrial dusts conveyed through local exhaust systems will range from 0.01 to 100 grains per cu ft with 1 to 10 grains per cu ft being the more common; (2) in heating and ventilating work, the concentration of solids will be those found in the outside atmosphere and will vary from 0.2 to 10 grains per 1,000 cu ft; (3) for pneumatic conveying, the concentration will range from 50 to 20,000 grains per cu ft.

The accompanying chart and table, compiled by S. Sylvan of American Air Filter Co., Inc., cover an air filter range with concentrations varying from 0.001 to 3 grains per 1,000 cu ft; and a dust collecting range with concentrations varying from 0.003 to 100 grains per cu ft. The commonly encountered ranges of concentration and particle size for many dust producing operations can be plotted on the chart from Table 1 in a manner similar to that shown for the example covering driers, kilns and coolers. For comparative or unknown conditions, these data will be sufficient, although variations either exceeding or falling short of the concentrations shown will be found. For applications not given in the table, it will be necessary to select a point on the chart by comparing with an operation that is shown. This comparison can be made on the basis of type of aerosol, method of generation, capture velocity at and location of the hood, and choice of excessive or minimum air volumes. Experience with the operation will also be of great aid in proper selection of concentration. Perfect pin-pointing of the concentration within the range shown for that application is not essential. The accuracy of the chart is such that any minor error made will not greatly affect the end result, which will be an approximation in any event.

Information concerning the concentration of various dust producing sources has been compiled from literature and experience in the field.

How to Use the Chart

A suitable collector will be selected for a lime kiln to illustrate how the chart is used. Referring to Table 1, the concentration and mean particle size of the material leaving the kiln will lie between 1 and 50 grains per cu ft and 3 to 25 microns respectively. Striking the geometric mid point of each range, on Fig. 1, one can assume an inlet concentration of 7.5 grains per cut ft and inlet mean particle size of 9 microns. Projection of this point vertically downward to the collection efficiency portion of the chart will indicate that a low resistance cyclone will be less than 50% efficient; a high efficiency centrifugal will between 60 and 80% efficient and a wet collector, fabric arrestor and electrostatic precipitator will be 97% plus efficient. The latter three collectors are often preceded by a centrifugal precleaner, so a high efficiency centrifugal will be selected. Using the average or center line of this group, the efficiency will be 70%. Therefore the effluent from this collector will have a

TABLE 1.—CONCENTRATIONS AND PARTICLE SIZES OF DUSTS FROM VARIOUS SOURCES

Dust Source	Range of Concentration, Gr per Cu Ft	Mass Mean Particle Size, Microns
Abrasive Cleaning:		
Blasting, tumbling (grit, sand) mills	0.5 to 15.0	3 to 10.5
Driers, Kilns, Coolers:		
Tube, flash, rotary	1.0 to 50.0	3 to 25
Melting Furnaces:		
Brass, steel, blast, smelter cupola	0.2 to 10	5 to 20
Fly Ash:		
Hand, stoker, pulverized coal firing	0.2 to 5.0	8 to 18
Foundry:		
Sand systems	3.0 to 7.0	2 to 10
Shakeout	0.5 to 3.0	0.8 to 3
Metal Working:		
Grinding	.05 to 0.5	10 to 100
Fumes	.005 to 0.2	0.2 to 0.7
Oil mists	.014 to 1.0	0.5 to 3.0
Acid Mists:		
Open surface tanks	.005 to .014	0.5 to 3.0
Atmospheric Dusts:		
Rural	.00002 to .00005	0.3 to 3.0
City	.00005 to .0002	
Industrial	.0002 to .0075	
Pneumatic conveying	50 to 20,000	over 100

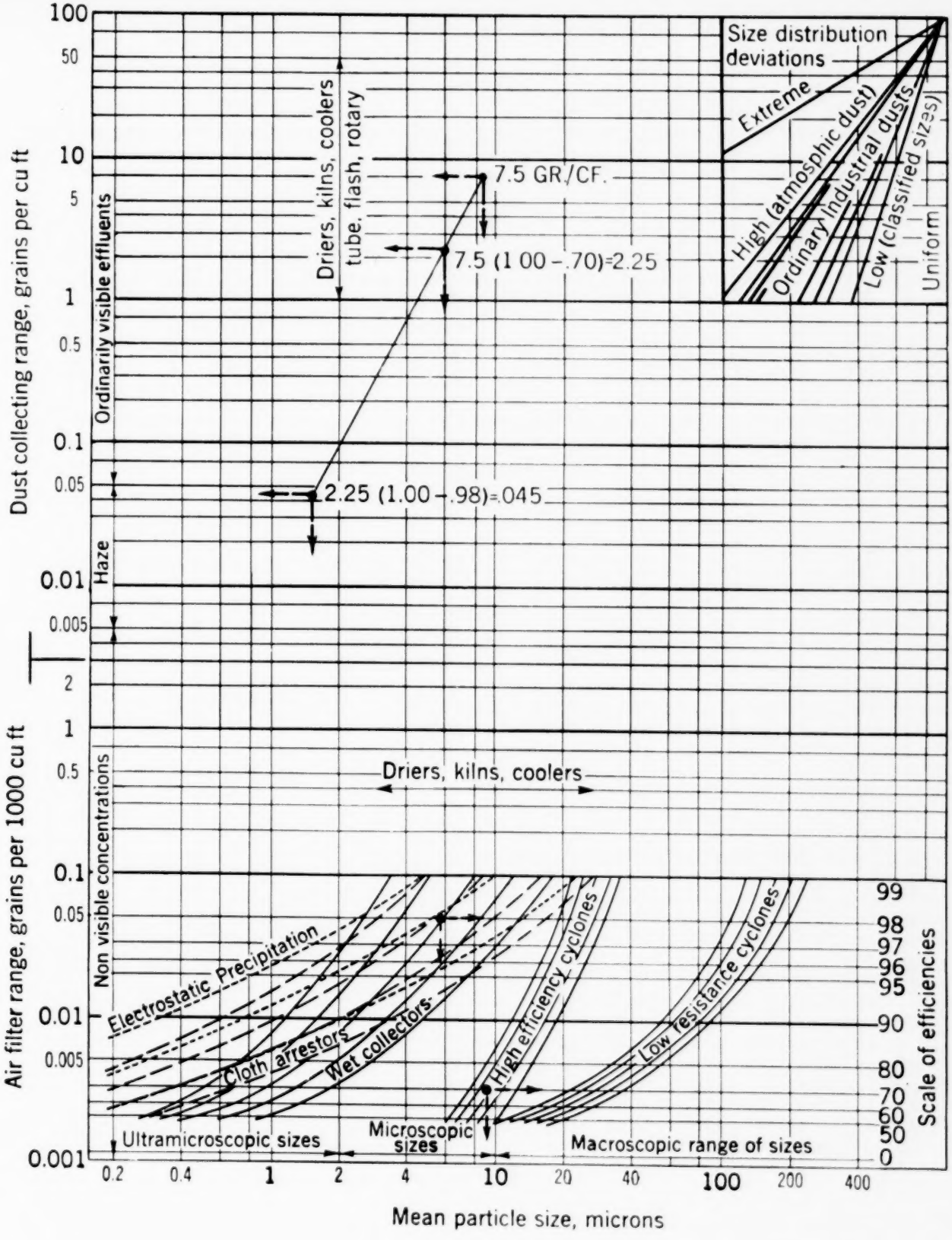


Fig. 1. Ranges of particle size, concentration, and collector performance. This chart and Table 1 are an adaptation of a chart compiled by S. Sylvan and copyrighted by American Air Filter Co. Principle sources of data are (1) a chart compiled in 1931 by W. G. Frank of American Air Filter Co. showing size and characteristics of air borne dusts, and (2) a chart of concentrations of particulates found in air compiled in 1952 by Philip Drinker and Melvin First of Harvard University and published in Heating and Ventilating and in The Archives of Industrial Hygiene and Occupational Medicine.

concentration of 7.5 (1.00 — .70) = 2.25 grains per cu ft. Draw a line through the initial point with a slope parallel to a selected average of the lines marked "industrial dust." Where deviation is not known, using the average of this group of lines will normally provide a margin of safety in predicting the mean particle size of the collector effluent. Where this line intersects the line marked 2.25 grains per cu ft indicates the mean particle size of the collector effluent. This is 6.0 microns.

A projection of this point of collector effluent vertically downward shows that a second high efficiency centrifugal will be less than 50% efficient. A wet collector, fabric arrestor and electrostatic precipitator will be not less than 93% efficient. Selection of an average wet collector will show an efficiency of 98%. The effluent leaving this collector will have a concentration of 2.25 (1.00 — .98) = .045 grains per cu ft. Using the line initially drawn, at the point where it intersects the line of .045 grains per cu ft will indicate a mean particle size in the effluent of 1.6 microns.

This chart enables anyone encountering a dust control problem to select two important variables, concentration and mean particle size. By knowing these conditions and the amount of collection efficiency needed, the necessary collector or collectors can be selected so that one can closely predict the concentration and mean particle size of the material going to the atmosphere. Selection and arrangement of particle size, concentration, and collector efficiency ranges are guided by considerations which follow.

Particle Size

Most dusts are composed of particles of many different sizes. Airborne dusts generally have a limiting upper particle size but contain a gradation of particles all the way down to the very finest. The most common unit of particle size is the micron, defined as 1/1,000 millimeter (1/24,500 inch); it is normally designated by the symbol μ. The average or effective diameter of the particle usually designates the particle size. Differentiation between small, medium and large particles is arbitrary. The Manufacturing Chemists Association in their Air Pollution Manual designate fine as less than 10 microns, intermediate from 10 to 50 microns and coarse as greater than 50 microns. On the Sylvan Chart, differentiation has been shown as ultramicroscopic, microscopic, and macroscopic ranging from 0 to 1 micron, 1 to 10 microns and 10 to 1,000 microns respectively.

The mass mean particle size of aerosols for some of the more common applications is shown in Table 1. The mass median represents that size for which the weight of all larger particles is equal to the weight of all smaller particles. Again, deviation from the information presented on the chart will certainly be found, but for approximation purposes the particle sizes shown are sufficient. The ranges shown have been compiled from literature and experience. For applications other than those illustrated, follow the same general procedure as indicated previously in the discussion of concentration.

Size Distribution Curve and Deviation

As dusts found in practice rarely consist of particles of a uniform size, to define them it is necessary to specify not only the various sizes but also the relative amounts of each size, that is the size distribution.

Two methods of plotting particle size distribution are the size frequency curve and the cumulative curve. In the size frequency curve, the number or weight of particles in a given size range is plotted against the average particle size of the range. Rarely is the distribution symmetrical about the preferential size. With dusts it is not uncommon to have two or more preferential sizes in a size frequency curve. In a cumulative curve, the fraction of the total number or weight of particles which have a diameter greater (or less) than a given size is plotted against this size. This curve is more generally used for dusts.

For purposes of presenting, comparing, analyzing or extrapolating particle size analysis in dust control work, the logarithmic probability graph scale is convenient. On this scale, particle size is plotted against the cumulative weight percent larger (or smaller) than that size on an integrated probability scale. Plots on this scale frequently give straight lines or lines of relatively small curvature. With this curve, the distribution function can be defined in terms of two parameters, the median size and standard geometric deviation. Standard geometric deviation is expressed as the 84.13% size divided by the 50% size.

An actual distribution curve may contain several intricacies, and it may not be possible to state it mathematically with a finite number of parameters. However by using two independent variables, mean size and deviation, in a mathematical function, it has been shown by Sylvan that:

$$\frac{C_i}{C_o} = \left(\frac{D_i}{D_o}\right)^{3 + \frac{N}{M}}$$

in which C_i, C_o, D_i and D_o are inlet concentration, outlet concentration, inlet mean particle size and outlet mean particle size respectively. The value of the exponent M varies for different types of cleaners. For pure impaction, theoretically it should be between 0.5 and 2. The extremes are never reached in practice and M varies no more than between 0.85 and 1.3 for cleaners of the impaction class. In cleaners where diffusion plays an important part, M may go down to zero and may even reach negative values. Accordingly, the Sylvan chart is useful for impaction type cleaners only. For these cleaners, the variation in M can be neglected without too great an error. The N is a dimensionless number depending upon the type of dust and is an arbitrary value depending upon the size frequency curve. The above equation states that when a line is drawn on a logarithmic chart connecting the inlet concentration and inlet mean particle size with the outlet concentration and outlet mean particle size, this line will have a slope of $3 + \frac{N}{M}$

Visibility of Stack Effluents

Range of visible concentrations has been reported as starting at 0.005 grain per cubic foot. This scale refers only to ultramicroscopic particles and cannot be used for most industrial stack effluents. There has been little

work done in this field but it is apparent that with coarser particles, much heavier concentrations could be discharged without a visible haze.

Collectors and Collector Efficiency

This term refers to the weight ratio of dust collected to that entering. Usually the prime consideration is the concentration of dust in the effluent regardless of inlet concentration. However, neither collection efficiency nor exhaust concentration is in itself a specific characteristic of a given collector. There are many factors involved in selecting dust collectors other than collection efficiency, such as: gas properties, dust properties, operating and maintenance considerations, construction and installation factors and auxiliary equipment.

There are approximately seven different classes of dust collectors: gravity settling chambers, inertial separators, packed towers, fabric arrester, wet scrubbers, electrical precipitators, and miscellaneous including sonic and thermal. For convenience the four major classes have been illustrated on the chart: inertial separators, wet scrubbers, fabric arresters, and electrostatic precipitators.

(1) The inertial separators have been divided into two groups: low resistance cyclones and high efficiency cyclones. The latter include mechanical centrifugal collectors.

(2) The wet scrubber group includes only those that rely on impingement, diffusion or centrifugal action for their primary means of collecting.

(3) The fabric arrester group embraces all collectors using fabric media through which the air stream must pass.

(4) The electrostatic precipitator group includes both the high and the low voltage types.

The collection efficiency of these four groups has been plotted against mass mean particle size.

All of the results shown in the graph were found through laboratory and field testing and were not computed mathematically. The number of lines shown for each group indicates more than a range for different makes of collectors operating with the same principal. Such variables as specific gravity of the dust, inlet velocity, size of unit, etc., in the centrifugals: water rates, method of scrubbing or impingement, etc., in wet collectors: velocity, type of medium, method of vibration, etc., in fabric arrestors: and velocity, voltage, resistivity of the dust, etc., in electrostatic precipitators determined the different efficiencies.

Heat Exchanges in Floor Panel Heated Room

The second in a continuation of experimental studies to be undertaken in the ASHVE Environment Laboratory was reported on July 1 at the Semi-Annual Meeting of the Society at the Shirley-Savoy Hotel, Denver. The study dealt with heat exchanges within a floor panel heated room in which all surface temperatures were uniformly controlled.

The report, by three members of the Society's Research Laboratory in Cleveland, L. F. Schutrum, research fellow, G. V. Parmelee, research associate, and C. M. Humphreys, senior engineer, who presented the paper, was described as the second in a series concerned with heat exchanges within panel heated and cooled spaces.

The ASHVE Environment Laboratory is equipped and instrumented for direct measurement of heat flow rates through all six surfaces of the room. The interior surfaces are made up of 75 aluminum panels of various sizes, arranged to provide maximum flexibility in surface temperature control. All room side surfaces were covered with a semi-gloss gray paint. Dimensions of the room are 24 feet six inches by 12 feet with an eight-foot ceiling.

Infiltration was recognized as an important factor affecting both room air temperatures and panel outputs. The infiltration air, introduced into the room by way of six vertical two-inch diameter perforated pipes closed at the top, was metered by means of an orifice.

Most of the experimental work reported in this study was carried out under conditions seldom, if ever, encountered in normal practice: the room unfurnished and unoccupied, all parts of the ceiling and walls at the same surface temperature, and the entire floor area heated to a uniform temperature. However, tests of this type are considered essential for the development of basic information, to be used with data from tests which are now being made under conditions more nearly representative of practical operating conditions.

Conclusions

While limitations imposed by the conditions under which the tests were made are recognized by the authors, the following observations are justified:

(1) Pending the establishment of data on the radiative and convective components of the total heat output from floor panels, studies of which are currently under way, the values for total panel output obtained in these tests indicate that the values previously given are of the right order of magnitude for unheated mean radiant temperatures of 65F.

(2) Room air temperatures were found to be higher for a floor panel heated room than for a ceiling panel heated room for the same room surface temperatures.

(3) The effect on the room air temperature at the 60-inch level of varying the amount of infiltration air and its entering temperature was about the same in the floor panel tests as it was shown to be in the ceiling panel tests.

(4) In none of the tests reported here did the air temperature gradient in the room between the two-inch and the 90-inch level exceed 3.5 degrees.

Boiler Tube Temperatures

SAFE operation of modern large steam boilers depends, in a large degree, on accurate measurement of tube temperatures. The high temperatures and pressures have made conventional safety factors obsolete, and tube temperature readings are now the most readily available guide to operational trouble spots.

There are actually eight different techniques for installing thermocouples that assure a positive contact between the temperature-sensitive element and the boiler tube.

By installing thermocouples properly and utilizing a high-speed scanning system (like Minneapolis-Honeywell's which provides as many as 270 temperature point readings at the rate of one point per second), an operator can locate an excessively hot tube immediately. As added protection, this type of scanning system will actuate both audible and visible alarms when any single temperature exceeds its set point. The operator, thus alerted, studies the 12-inch strip chart record and spots the hot tube easily since the value of the temperature and its identifying number are clearly printed. Since some tubes in a boiler normally operate at higher temperatures than others, the temperature points are arranged in banks of 18. Each bank can have any set point within the range of the scanner system.

Thermocouples made of 14 or 20 B&S gage wire have been found adequate for superheater tube installations. Most commonly used is 14 gage because its larger size favors greater service life. Chromel-alumel wires, durable product of Hoskins Corp., are used exclusively in the M-H device.

Installing any wire in a reducing atmosphere shortens service life. In atmospheres up to 800F, an asbestos insulation is adequate to protect the thermocouple wires from contamination. Above that temperature, porcelain insulators on the thermocouple wires provide sufficient protection against contamination. If the wires are not protected, contamination progresses and the wires absorb and combine with materials in the flue gas, particularly sulphur, and the temperature-emf relation of the thermocouple is altered.

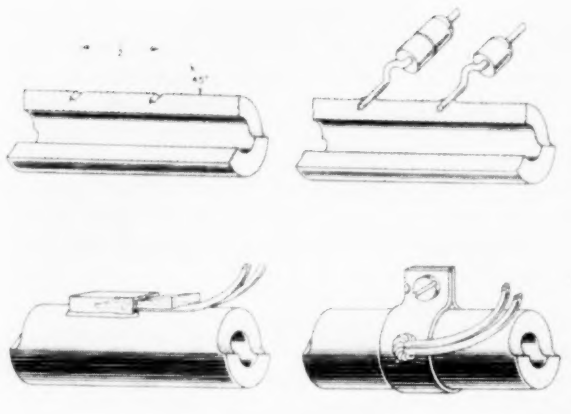
Installation Methods

The value of the finest temperature measuring equipment can be nullified by improper thermocouple installation. The following methods place the thermocouple in intimate contact with the area to be measured.

(1) Spot temperature measurement—The thermocouple measuring junction is welded to the boiler tube. Installation is inexpensive and easy.

(2) Average temperature measurement—The thermocouple measuring junction is broken and one wire of the couple is welded to the boiler tube; the other wire of the couple is welded to the opposite side of the tube. The measuring instrument when connected to this couple indicates the average of the two temperatures at the welds.

(3) Thermocouple peened into drilled holes—Holes are drilled either vertically or at a 45-degree angle, one-half inch apart, and to an approximate depth of 1½ times the diameter of the thermocouple wire. Wires are then inserted and peened into place. Some customers give the wire and insulation additional protection by fastening the wires to the tube with a Chromel strap and covering the assembly with alundum cement containing 5% loose asbestos. This method requires no welding but peening may be difficult in cramped quarters. The union is likely to be less secure than welding and the wall thickness of the tube is reduced at the drilled area.



How to install thermocouples.

(4) Wires are held in a small steel tube welded to the boiler tube—A small diameter steel tube is welded to the boiler tube. The thermocouple measuring junction is placed within the steel tube and it is then flattened with a hammer, thus holding the thermocouple securely in place. The thermocouple junction is easily installed, but the steel tube is difficult to attach.

(5) Bracket and wedge—A small bracket is welded to the boiler tube. The thermocouple wires are then inserted and fastened securely by driving the wedge into place. The advantages and disadvantages are the same as those for the previous technique.

(6) Thermocouple wires welded to clamp—Wires are welded to a pipe clamp. The clamp can then be attached to the boiler tube at any desired point. The clamp should be of stainless or moly-stabilized chrome steel to prevent corrosion and oxidation. Mounted by this method, thermocouples are easy to install and replace.

(7) A nut having a small hole drilled through its side is welded to the boiler tube. The thermocouple wires are inserted into the hole and a bolt is screwed into place forcing the wires firmly against the tube. The advantages and disadvantages again are similar to those listed for methods four and five.

(8) Protected thermocouple for superheater tube temperature measurement—This thermocouple was designed for extremely long life. Its stainless steel construction makes it particularly durable. The method of fastening to tubes is similar to the bracket and wedge method. Although long life is assured, the protected thermocouple is more expensive than the unprotected ones.—F. D. Dodge, Minneapolis-Honeywell Regulator Co.

Flow and Fan—

Principles of Moving Air through Ducts

C. HAROLD BERRY

Gordon McKay Professor of Mechanical Engineering, Harvard University

Part 7. Fan Performance

Various factors involved in performance, especially of centrifugal fans, are taken up in this seventh of a 12-part series.

THE fan is a machine fitted with a rotating impeller, or wheel, which does work upon the gas flowing through it. Fans are of many types, ranging from the simple open propeller, as in the ordinary desk fans for stirring up the air of a room, through more elaborate axial-flow fans enclosed in a duct or casing, to the centrifugal fan with predominantly radial outward flow through the wheel to the surrounding casing. The wheel may be fitted with blades stamped from sheet metal or with streamlined blades resembling the wings of an airplane. The casing may be a simple enclosure to guide the air flow into the inlet of the wheel and from the exit of the wheel to the discharge opening, or the casing may be fitted with guide vanes at entrance or exit or both, stamped from sheet metal or streamlined, fixed or adjustable.

Various names are used. Such names as blower, booster, exhauster, refer to the position of the fan in the duct system rather than to the type of fan. Machines designed to produce relatively large pressure rise are usually called compressors, axial-flow or centrifugal. The basic principles underlying the operation of all these machines are the same; only the details of design and operation vary from one type to another.

In all cases the wheel is the only part of the fan that does work upon the gas flowing through it. While the casing and guide vanes collect and direct the flow, they can do no work on the gas because they are stationary. Work requires motion. It is true that the flowing gas expends work against frictional resistance, but this work is dissipated in producing a heating effect, slightly warming the gas and the confining walls; the stationary walls can neither receive nor deliver work.

The response of a fan to varying resistance of the duct system is customarily set forth in so-called characteristic curves showing the relation between the rate of flow, the pressure developed by the fan, the power required at the fan shaft, and the efficiency of the fan, which is the ratio of the work actually delivered to the flowing gas to the power required on the fan shaft.

There is no way to forecast the detailed shape of the characteristic curves; no more than general tendencies can be indicated, as we shall see. Only by test can the precise form of the curves be established. Such tests show that various types of fans have typical characteristics, which we shall shortly examine. In addition to this influence of system resistance, fan performance is influenced by the size of the fan, the speed at which it is driven, and the density of the gas flowing through it. We shall examine these various influences separately and finally arrive, let us hope, at a reasonably unified concept of the essentially simple relationships.

Fan Testing; Characteristic Curves

We set up a chosen fan, run it at a convenient constant speed, handling the atmosphere of the laboratory. Corrections for small variations in speed and density will be discussed later. The fan is set up with open inlet and with a discharge duct long enough to provide good conditions for observing the flow. At a proper point in this duct provision is made for traversing the duct with a Pitot tube whereby the average velocity is measured. The arrangement is shown in Fig. 42. The duct area being known, the quantity Q is computed. The Pitot tube also gives a reading of the total pressure in the fan discharge; the suction total pressure is zero (atmospheric); the rise in total pressure is thus measured. (Other measuring means are sometimes used, but this is not the place for discussing them).

To vary Q, the test duct is fitted at its outer end with a symmetrical obstruction which may be one of a group of orifices of various sizes, a conical throttle forming a large needle valve, or a frame holding slats like a picket fence, slats being added to restrict the flow.

Finally, a dynamometer measures the power delivered to the fan shaft, called the shaft horsepower or the brake horsepower (a dynamometer is often called a brake).

For full details of testing procedure one must consult the accepted test codes, such as those sponsored by the National Association of Fan Manufacturers and the American Society of Mechanical Engineers. These codes are quoted in many handbooks and textbooks, but if important work is in hand, it is well to secure the latest edition of the appropriate code from one of the sponsoring societies. Frequent revisions keep these codes up to date.

Let us suppose the test started with no obstruction at

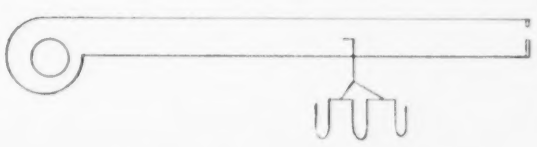


Fig. 42. Fan test set-up.

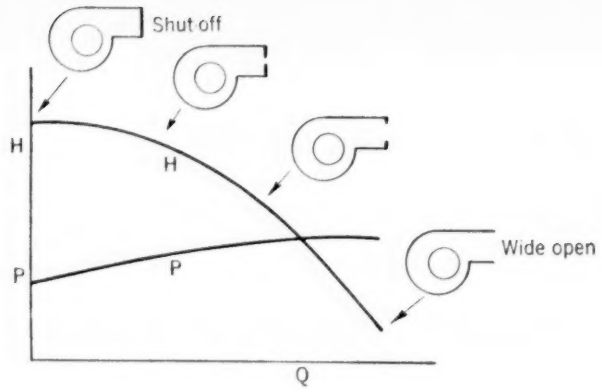


Fig. 43. Fan test procedure.

the end of the test duct. The only resisance will be the duct friction, which is small and is computed out of the results. The fan is said to be wide open. A large quantity flows. The static pressure developed is small (static pressure must be zero for free discharge); but velocity pressure has its maximum value, and hence total pressure cannot be zero. The shaft power is high.

Next we obstruct the end of the test duct. The flow, Q (cfm), is reduced, the pressure rise, H (inches of water, static or total), is increased, and the shaft power, P (horsepower), may be less, or more in a restricted range for some fans. Thus we proceed, conducting test runs (often ten of them) with progressively more obstruction until at last we have the duct closed off entirely in what is called the shut-off or blocked-tight condition of zero flow. At this point the pressure is called the shut-off pressure or the static no delivery pressure, abbreviated SND pressure.

The results are plotted against Q as abscissa to provide the characteristic curves of the fan that was tested, such as those in Fig. 43.

From Q and H the air horsepower is computed, either the real power based on total pressure or the fictitious static power based on fan static pressure. See Equations (161) and (163) in Part. 6. The ratio of air horsepower to shaft horsepower is the efficiency, denoted as total or static to indicate which air horsepower was used.

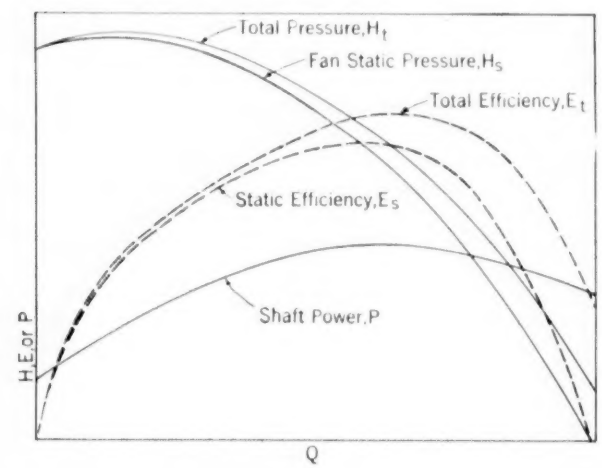


Fig. 44. Typical characteristic curves.

The fan characteristic curves often include all of these items except the air horsepower. Fig. 44, taken from an actual test, illustrates the appearance of such curves. The coordinates are preferably given in physical units (inches of water, cfm, hp) but are sometimes given in percent: Q as percent of wide-open Q, H as percent of shut-off H, P as percent of wide-open P or of maximum P if the power curve shows a maximum.

The difference between H_t and H_s is, of course, H_v; the vertical interval between the two curves is proportional to Q^2. When the fan operates wide open, $H_s = 0$ and $H_t = H_v$. This is the end of the total-pressure curve.

The Influence of Fan Type; Centrifugal Fans.

Each general class of fan performs in a typical fashion, and we wish to consider in a general way how the various types may be expected to behave under operating conditions. For the open propeller (the desk fan) there is little to say; we shall say nothing. It will be convenient to start with the centrifugal fan.

Fig. 45. Types of centrifugal fan wheel blading.

The centrifugal fan is an outgrowth of the simple paddle-wheel fan in which the wheel is an open spider carrying radial flat plates. This primitive wheel is still used in non-clogging fans handling bulky or sticky or abrasive material in suspension. Refinements of design have developed three general types in wide use today, wheels with radial tip blades, with blades curved backwardly, and with blades curved forwardly at their exit edges. As sketched in Fig. 45, all have forwardly-curved inlet edges to ease the flowing air into the rotating wheel with smaller loss due to impact or shock. A further attempt to reduce shock loss is the airfoil shaped blade such as the Sturtevant blade shown in Fig. 46.

Fig. 46. Airfoil blades.

Each type of fan shows a tendency to operate in a typical fashion which may be indicated by a simplified consideration of what happens to the gas flowing through the rotating wheel.

In every case the work done by the wheel per cubic foot of gas equals the total pressure rise developed by the wheel, and, other things being equal, this is proportional to the tangential component of the absolute velocity of the gas at exit from the wheel. This statement is subject to many qualifications, but this is not the place to discuss the complete theory of fan design and operation; it is sufficient here to know that we can learn something about fan performance by considering the variation of the tangential component of the exit velocity as the rate of flow varies.

As a first step, let us consider the three types of wheels standing still, with air blown through them by some outside means. To develop an approximate analysis, we assume that each wheel has a number of blades sufficient

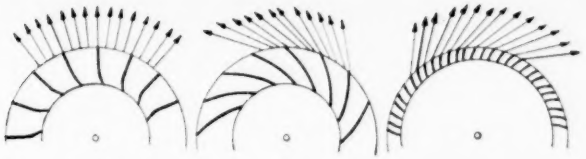


Fig. 47. Air flow from stationary fan wheels.

to ensure that all of the air flows out in a direction (relative to the radius) defined by the inclination of the outlet edges of the blades. Fig. 47 pictures this for a given of flow. If the flow were larger, the velocity would be higher and the arrows representing velocity would be longer, but unchanged in direction.

When the wheel is rotating it is assumed, quite reasonably, that the exit velocity of the air relative to the impeller is the same as pictured in Fig. 47. But with the wheel rotating the air is emerging from the outside of the wheel which is moving at the peripheral velocity of the wheel, often called the tip speed. Thus the absolute exit velocity of the air must be the sum of its velocity relative to the wheel plus the tip speed of the wheel. Adding these two velocities in the usual parallelogram fashion gives us their sum, which is the absolute exit velocity of the air, as indicated in Fig. 48, which shows also the tangential, or rotational, component of the absolute exit velocity. It is this tangential component that is proportional to the total pressure rise developed.

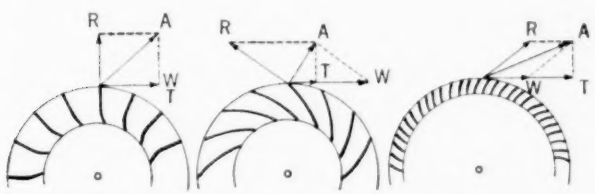


Fig. 48. Velocities and components. Vectors: R = relative velocity; W = wheel tip speed; A = absolute velocity of air; T = tangential component of absolute velocity.

Fig. 48 presents an interesting fact. In the radial-tip wheel, the absolute exit velocity of the air always exceeds the tip speed of the wheel, and in the wheel with forwardly-curved blades the exit velocity of the air may be considerably higher than the tip speed of the wheel. On the other hand, the air velocity leaving the wheel with backwardly curved blades may be lower than the tip speed of the wheel. There is nothing mysterious about this, but it is worth mentioning because now and then one hears

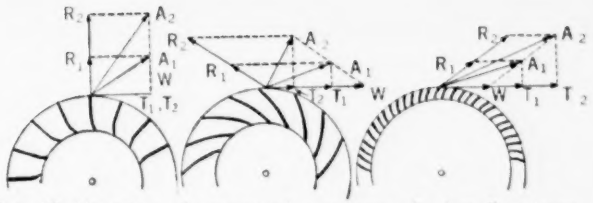


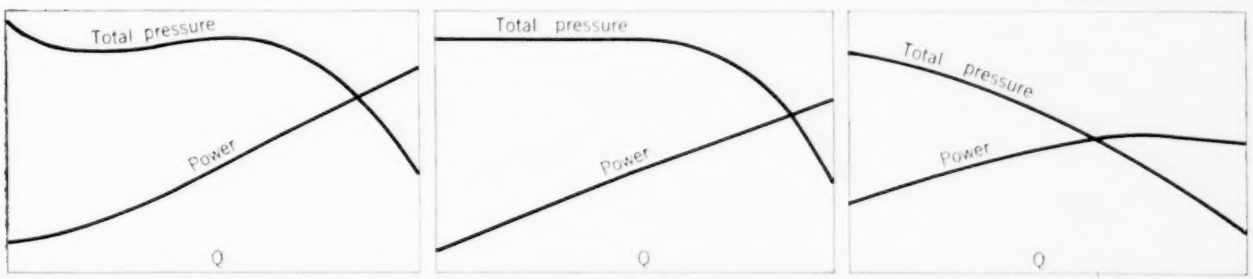
Fig. 49. Variation of tangential component for low flow (subscript 1) and high flow (subscript 2).

the false assertion that it is impossible for a fan wheel to discharge air at a velocity higher than its tip speed, and it is good to know how to controvert this error.

Finally, let us consider how the tangential component of the exit velocity varies as the rate of flow varies. Fig. 49 shows what happens for two rates of flow. As the rate of flow increases, the velocity relative to the wheel increases, but with the fan running at constant speed the tip speed of the wheel does not change. It is evident that for the wheel with radial-tip blades the tangential component of the exit velocity is always identical with the wheel tip speed, and hence is constant. For the wheel with backwardly curved blades the tangential component decreases as the flow increases, and for the wheel with forwardly curved blades it increases.

Since the total-pressure rise developed by the fan is to a first approximation proportional to the tangential component of the absolute velocity at exit from the wheel, we may expect that the three types of wheels will show characteristics behaving in much the same way. The radial tip wheel should show a virtually constant total pressure rise with varying flow rate. The backwardly-curved blade wheel should show a so-called drooping characteristic, with total pressure falling off as flow increases. The forwardly-curved wheel should show increasing total-pressure rise as flow increases. The characteristic curves shown in Fig. 50 are drawn to scale from actual tests of fans of the three types, and indicate that these conclusions are confirmed by the general trend of the test curves. The departures at low flow are due largely to friction and shock losses within the wheel and the surrounding casing. The high rates of flow are obviously associated with low resistance, so that ultimately the curve for any kind of fan must turn downward toward zero pressure rise.

The power curves shown in Fig. 50 indicate that the radial-tip fan may be expected to have a power demand rising steadily with increasing flow, and that the forwardly-curved blade fan will be likely to show an even higher rate of power increase. If the actual resistance of a duct system turns out to be smaller than the estimate



Forwardly curved Blades | Radial tip Blades | Backwardly curved Blades

Fig. 50. Test curves for centrifugal fans with three blade types.

tor which the fan was selected, the actual flow will exceed the estimated flow, and it may be that the driving motor will be overloaded. On the other hand, the fan with backwardly-curved blades will probably show a power demand passing through a maximum; this type of fan is therefore often said to have a self-limiting power characteristic. If the driving motor is rated to carry this maximum power it cannot be overloaded under any conditions at the given speed.

We may summarize briefly the salient features of the three types of centrifugal fans by stating the extremes for the backwardly curved and the forwardly curved blades. In each respect the radial tip fan is intermediate between these extremes. The brief statements in Table 5 must not be regarded as more than rough approximations; individual examples might be cited in disagreement with them. They represent tendencies that may reasonably be expected.

TABLE 5—SUMMARY OF CENTRIFUGAL FAN FEATURES

Backwardly Curved Blade Fan	Forwardly Curved Blade Fan
Efficiency high Advantageous when the fan is expected to run many hours per year.	Efficiency low Unimportant for intermittent operation and small power.
High speed for given fan and duty. Advantageous for direct-connected a.c. motor drive.	Low speed for given fan and duty. Conducive to quiet operation.
Large fan for given duty. May be unimportant in industrial work.	Small fan for given duty. Advantageous in ventilating work where space is limited.
High cost for large fan.	Low cost for small fan.
Self-limiting power demand, Important for elaborate systems for which exact estimate of resistance is difficult.	Sharply rising power demand Presents no difficulties if resistance is accurately forecast.

The backwardly curved blade fan is preferred by many engineers for undertakings involving large power demands and nearly continuous operation. For example, this type of fan is considered by many to have distinct advantages for forced draft service for large power boilers. The forwardly curved blade fan, on the other hand, is preferred for services in which the first cost must be kept down, and especially for intermittent service, where the lower efficiency will be relatively unimportant. Restricted space likewise favors the forwardly curved blade fan. Ventilation fans are often of this type.

In some situations other considerations dominate. If the gas to be handled carries abrasive or sticky dust, such as damp ash dust from a boiler, neither of these types is a wise choice because either of these fans is subject to severe abrasion, and either of them can collect deposits of material on the concave faces of the blades. These deposits may build up with fair symmetry until they reach a point where large gobs of material fly off. This usually results in serious mechanical unbalance and intolerable vibration of the machine. For such service the radial-tip blade is much to be preferred, since it is unlikely to collect deposits. Even it is subject to serious damage from abrasive dusts, and for such service the blades are often reinforced by wearing strips that can readily be replaced from time to time.

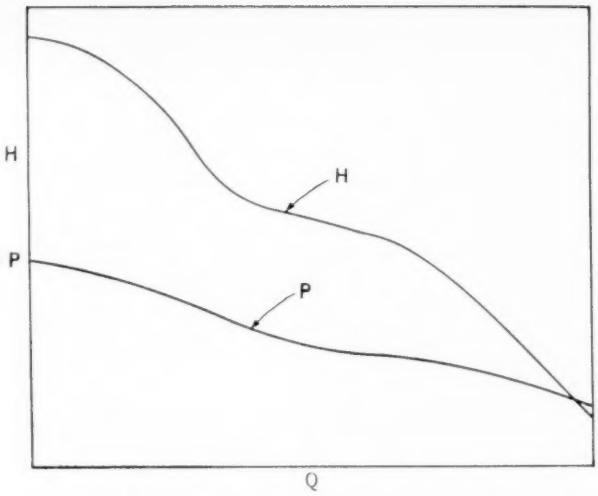


Fig. 51. Test curves for axial-flow fan.

For exhaust systems that handle fibrous or bulky materials, such as lint or shavings, special types of fans have been developed with few blades of simple shape.

Axial Flow Fan Characteristics

The axial flow, or propeller, type of fan has characteristic curves that differ markedly from those for centrifugal fans, especially in respect of the power required. Fig. 51 shows typical curves. The pressure developed falls sharply from its maximum at zero flow, and the power curve follows much the same course.

It seems evident that this type of fan is best adapted to handling large volumes against low resistance. In its simpler forms, the propeller fan is most often used for ventilation service, often mounted in an opening in a wall, with no duct work. During the last two decades the propeller, or axial flow, fan has been the object of extensive study and development, so that today fans of this type, comprising impellers with streamlined blades mounted in ducts, often fitted with guide vanes, are used to deliver large volumes of air against high resistances with high efficiency. Perhaps the outstanding deficiencies of the axial flow fan are that at certain rates of flow it tends to pulsate badly and that, due to its high rotative speed, it tends to be excessively noisy.

Equivalent Orifice—Point of Rating

Each point on the fan characteristic curve of H against Q corresponds to a particular degree of restriction of the test duct, i.e., to a particular system resistance, so that a point on the curve may be designated as corresponding to a given equivalent orifice.

Another phraseology is to refer to a given point as a point of rating, sometimes in terms of percentage of wide-open Q and of shut-off H.

Fan Rating

It is customary to assign to a fan (as to many machines) a definite rating, that is, a single pair of values of Q and H at which the fan should preferably be oper-

ated or is expected to operate. This is a compromise between efficiency and capacity. From the standpoint of power demand it would be best to operate a fan at its highest efficiency. From the standpoint of volume of gas handled or, inversely, the size of fan required for a stated capacity, it is preferable to run the fan somewhat to the right of its maximum efficiency, i.e., with larger capacity for the same fan or a smaller fan for the same capacity, such as the point designated in Fig. 52. The smaller fan costs less and occupies less space, both items of importance. The cost of the fan affects the fixed charges, which must be met even if the fan is idle. The efficiency affects the power cost, but this depends upon the hours of running per year. For fans expected to run much of the time, the rating point will be closer to maximum efficiency; a fan expected to run only a few hours per year (or a few hundred; one year is 8760 hours) will be chosen for larger capacity and lower efficiency.

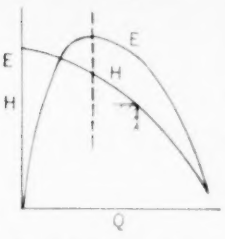


Fig. 52. Point of rating of a fan.

There is nothing magic about the rating point. A fan can be operated at any point on its characteristic curve. One must balance various considerations. It is usually not wise to run a fan much to the left of its maximum efficiency, for the fan becomes large for its capacity, and some fans tend to be unstable and noisy in this region. Operation far to the right entails low efficiency and low pressure developed.

We shall return to this question later.

The statement of the load carried by a fan or the duty of the fan is not readily made in terms of a single numerical value in general. Load is a combination of Q and H; horsepower might serve as a single figure, but it is not often used. Sometimes Q is used alone, sometimes H (total or static); with reference to a fan operating on a given system (perhaps with varying resistance) this practice is often satisfactory.

Both Q and H are involved in the concept of equivalent orifice, and this term is often used to refer to the fan duty, although it is not often expressed numerically as the area or diameter of the equivalent orifice.

Fan Performance

Non-uniform flow through the fan inlet does not supply air uniformly around the circumference, and the fan wheel therefore operates unsymmetrically, and may suffer a large decrease in capacity. Over part of the circumference, gas may be flowing outward, as it should, while over the other parts it may sometimes even be flowing inward. Swirling flow in the fan inlet also has serious effects; rotation of the entering gas in the same direction as the fan rotation reduces the pressure developed, and rotation against the fan rotation increases the power required to drive the fan.

Accordingly, anything which produces non-uniform or swirling flow on the inlet side of the fan is likely to impair the fan performance, perhaps seriously. A fan with open inlets may be located so that the air coming to it develops a spin around the fan axis, due to the presence of deflecting objects near the fan, or to the configuration of the fan room and ducts entering it. A fan with inlet boxes connected to a suction duct (i.e., an exhauster fan) may perform poorly because of the ill-conceived design of the inlet boxes.

Such situations arise in practice, and fortunately can be remedied by installing means for avoiding the non-uniformity or whirling nature of the flow. Splitters or guide vanes, which we have mentioned for use in elbows often serve well just ahead of a fan inlet. Egg-crate straighteners serve to reorganize swirling flow. Some fans are fitted with inlet guide vanes for this express purpose.

At the fan discharge a somewhat different situation exists. The fan produces non-uniform flow in its outlet. The emerging gas, spinning around the fan axis, tends to crowd to the outside of the discharge opening, in a manner somewhat similar to the gas passing round an elbow. During the usual test, a fan is fitted with a discharge duct, in which this non-uniform flow has time and space to become substantially uniform with some recovery of excess kinetic energy by abrupt expansion to uniform flow, but if the fan is set up in practice to discharge directly to the atmosphere (or a room) with no discharge duct, the excess energy of this non-uniform flow is lost. Accordingly, a fan set up without a discharge duct will fall short (sometimes far short) of its test performance.

The non-uniform flow through the fan discharge will have a marked influence on the loss through an elbow applied directly to the discharge, much the same as the influence of a preceding elbow. The orientation of the elbow makes a difference, just as it does in compound elbows.

The flow pattern in the fan discharge is likely to be different at different equivalent orifices, so that its influence may vary widely between various operating points on the characteristic curves.

Accordingly, in setting up a fan in practice, every effort must be made to avoid non-uniform flow in the fan inlet, and the fan should discharge into a length of straight duct before any elbows or other fittings are applied. Naturally, this is a counsel of perfection. When it is impossible to avoid such examples of bad design, it must be recognized that the performance of the fan will be poorer than expected.

In practice it frequently happens that circumstances prevent the installation of a fan so that it will be free from disturbing influences. Also, in practice, it often happens that there is no considerable length of straight uniform duct in which it would be possible to measure the volume rate of flow. Accordingly, it is rarely possible to test a fan after it has been installed for service. If the performance of a fan is to be tested to determine its conformity to specifications, such test must virtually always be conducted in a special set-up, preferably in a well equipped fan testing laboratory. One dare not draw conclusions from readings taken from the usual service installation.

Fan Performance in General

Now that we have seen something of the influence of the type of impeller on the performance of a fan, let us turn to a more general consideration which applies to any type of impeller. Our problem now is to consider the relative performance of like fans of different sizes, driven at different speeds, and handling gases of different den-

sities. The general relations which we shall develop apply equally to any form of impeller.

In the design or selection of a fan, many items must be determined. Some are fixed by the conditions under which the fan is to operate, others must be determined by computation, and others on the basis of judgment and experience. In general, these items may be classed in four groups: (a) Items which determine the type, style, etc. of the fan; (b) the size of the fan; (c) the fan speed; (d) the density of the gas to be handled.

(*a*) *Fan Type.* The items of group *a* consist of ratios among the linear dimensions together with a number of angles between various fan parts. A series of fans may be built all characterized by constant values of all of the items in group *a*. Such fans are referred to as "geometrically similar" or "homologous" fans. It is a widespread custom of the trade for manufacturers to put forth such series of fans. The geometrical similarity includes every portion of the fan; the impeller (or wheel), the casing, the discharge nozzle, the intake arrangements, and even the shaft, the hub, the bearing pedestals, and all other details that may in any remote way influence air flow into, through, and out of the fan. There are, indeed, some items whose influence is so small that it is customary not to be excessively fussy about them, such as the thickness of the sheet metal from which various fan parts are made, the precise details of bearing pedestal design, and the like. Just where the line must be drawn between items that are important and those that are not can be decided only on the basis of actual experience. In general, it may be said that all of the major dimensions of wheel and casing are important.

(*b*) *Fan Size.* For a given series of geometrically similar fans, a single dimension will suffice to fix the size of any member of the series. Usually the dimension chosen is the outside diameter of the rotating impeller. This, then, is the only item in group (b). All other dimensions of the fan will be proportional to the wheel diameter, both radial dimensions and axial dimensions. The drawings of two similar fans will be identical in all views, except for size or scale. One set of drawings might be made from another by photographic enlargement or reduction.

In a commercial series of fans it is common to have successive diameters in geometric progression, with a ratio not far from 1.10. Each size is designated by the impeller diameter, or by an arbitrary symbol, often a number proportional to the diameter.

(*c*) *Fan Speed.* Group *c* obviously consists of a single item, the rotative speed of the fan. Within limitations of physical strength and stiffness, any fan may be run at any speed.

(*d*) *Gas Density.* Group *d* also consists of a single item, the only characteristic of the gas handled that is significant for the fan designer—its density. We are not discussing chemical characteristics, such as the tendency to corrode metals. That is clearly a separate consideration, not affecting the mechanical design of the fan, but rather the choice of materials of construction. It is not so obvious that we should exclude the viscosity of the gas.* Usually gas viscosity is so small, however, that for moderately large fans (wheel diameters of 30 inches and upward) it shows no demonstrable effect on fan performance, that is, its influence, if any, is less than the uncertainties of test procedures and measurements.

*An interesting study of the influence of gas viscosity was presented by E. M. Fernald in Mechanical Engineering, 49, 9 (September, 1927), page 1004.

Fan Variables

Any fan will deliver gas at the rate Q and will require power P to drive it. How much gas? How much power? Clearly the answers to these questions depend upon all of the items we have mentioned. Expressing our problem in mathematical language, Q and P are the dependent variables to be evaluated as functions of the certain independent variables.

Assume that we have under consideration a given series of geometrically similar fans. Any fan of the series will be fully specified by giving the wheel diameter D, which may be chosen to have any desired value. This fan may be operated at any speed, N, rpm. When running at this speed, this fan may be caused to handle gas of any density, ρ. Thus, for a given series of fans, we have three independent variables: D, N, ρ. Each of these variables will affect the fan performance.

In addition, the resistance of the system to which the fan is connected will affect the fan performance; H_s (or H'_s) is a fourth independent variable.

So we have four independent variables, D, N, ρ, H_s, values of which determine the fan performance. The values of all four independent variables are arbitrarily disposable and will be discussed in Part 3, next month, with a continuation of the study of fan performance.

Air Space Height Affects Heat Loss Through Walls

A decrease in height of the air space in walls was found to lessen the heat loss through the wall. Dust patterns on walls are more pronounced where temperatures of adjacent portions differ by as little as 3 to 5F, ASHVE learned at their Semi-Annual Meeting.

The report was presented in a paper on the thermal performance of frame walls by G. O. Handegord, assistant research officer, Division of Building Research, National Research Council of Canada, and N. B. Hutcheon, professor of mechanical engineering, University of Saskatchewan, Saskatoon, Canada. The study was conducted as part of a program of cold weather wall research being carried on cooperatively by the University and Council.

The authors had previously prepared a paper on this subject which dealt with the vertical variations in temperatures and heat flow rates resulting from convection in air spaces in frame walls. The air spaces were continuous over the height of the wall. The present paper deals with walls having horizontal blocking at mid-height, and is concerned, as was the first paper, with the deviations of actual heat flow and temperature patterns from those predicted by simple theory.

Air Washer Performance

Analyzed on the Psychrometric Chart

Harold M. Hendrickson

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University of Washington, Seattle, Wash.

A presentation of simple methods for selecting air washers for heating and humidifying, as well as for cooling and dehumidifying, based on the use of the psychrometric chart. Problems are solved to show steps in calculations.

HEATING and VENTILATING'S REFERENCE SECTION

Air Washer Performance

Analyzed on the Psychrometric Chart

HAROLD M. HENDRICKSON

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The psychrometric chart is used in determining the required design data for satisfactory air washer performance. A number of illustrative problems are employed and the step by step procedure clearly indicated.

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AIR washers are frequently used in large central station air conditioning jobs, not only for their air cleaning ability, but for humidity control under both heating and cooling conditions. However, factual data concerning their performance are not readily obtainable from current trade literature or from manufacturers' catalogs. In the absence of test data under various operating conditions, some method of approximating performance characteristics is very much to be desired. This is an attempt to present simple and logical methods for selecting air washers for heating and humidifying as well as for cooling and dehumidifying.

Thermodynamic changes taking place between air and water in an air washer can best be analyzed graphically by diagramming the process on a psychrometric chart. Referring to the psychrometric chart of Fig. 1, with state point 1 as the condition of the air entering the air conditioning unit, the radial lines represent typical paths or directions in which thermodynamic changes may occur. Most of these changes can be accomplished by means of an air washer, viz.:

1-A, Cooling and dehumidifying when the spray water temperature is lower than the dew point temperature of the entering air.

1-B, Sensible cooling only when the leaving spray water temperature is at the dew point temperature of the entering air.

1-C, Cooling and humidifying, when the leaving spray water is lower than the dry bulb and higher than the dew point temperature of the entering air.

1-D, Humidifying only when the leaving spray water temperature is at the dry bulb temperature of the entering air.

1-E, Heating and humidifying when the leaving spray water temperature is higher than the dry bulb temperature of the entering air.

In the remaining three directions of thermodynamic change from state point 1, air washers are not normally employed, viz:

1-F, Sensible heating only, usually by means of a blast heating coil.

1-G, Heating and dehumidifying, usually by means of chemical absorbents or adsorbents.

1-H, Dehumidification only, usually by means of chemical dehumidification plus recooling.

However, air washers can be used for paths 1-G and 1-H by combining cooling and dehumidification with subsequent reheating.

In a properly designed air washer, water is brought into intimate contact with air. Under such conditions, there will be a heat exchange if the water temperature differs from the wet bulb temperature of the air. Also there will be a moisture exchange if the water temperature differs from the dew point temperature of the air.

If the air is heated as in Fig. 2*A*, warm water entering the sprays will be cooled down as the wet bulb temperature of the air is increased. In such a heating process, the final water temperature will always be higher than the final wet bulb temperature of the air unless we have a 100% perfect washer. Thus in an actual washer, there will always be a split or difference between the leaving water and the leaving air. However, when humidifying with hot water using a two-bank spray washer, practically 100% saturation will be reached and it is common practice to neglect the split under such conditions.

If the air is cooled as in Fig. 2*B*, cold water entering

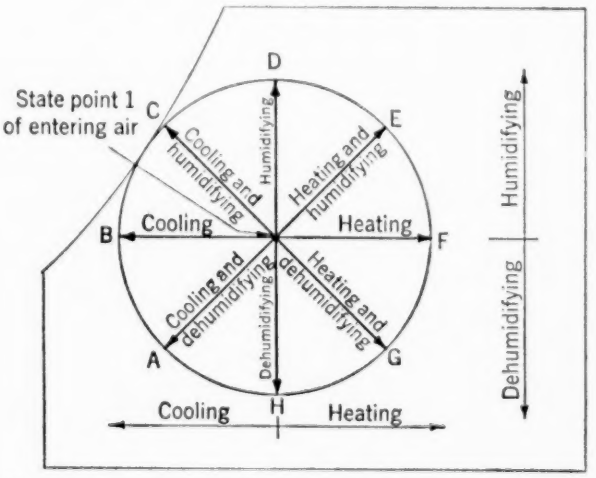

Fig. 1. Basic air conditioning processes plotted on the psychrometric chart.

the sprays will be warmed up as the wet bulb temperature of the air is lowered. In such a cooling process, the final wet bulb temperature of the air will always be higher than the final water temperature unless again we have a 100% perfect washer. There will always actually be a split between the leaving air and the leaving water. It is much more difficult to obtain saturation of the air when cooling and dehumidifying than when heating and humidifying. Splits of 1 to 4F between the leaving air and water temperatures are readily obtainable with proper design. Small splits are particularly difficult to obtain when the cooling load is largely sensible, as occurs with a large wet bulb depression in the entering air which indicates a relatively dry entering air condition. On the other hand, when there is a considerable dehumidification load (a load having a low sensible heat factor), the wet bulb depression of the entering air will be less indicating relatively more humid air entering, and closer splits are obtainable.

The evaporative cooling process is illustrated in Fig. 2C. Here the spray water is constantly recirculated so that it soon reaches an equilibrium with the wet bulb temperature of the entering air, both water and wet bulb temperatures becoming the same. The constant temperature spray water lowers the dry bulb temperature of the entering air so that it approaches the water temperature, which is at the air wet bulb temperature. Thus we have an adiabatic heat transfer process in which the wet bulb temperature of the air remains constant, but the dry bulb temperature drops as the humidity rises. Theoretically, if we have a 100% perfect washer, the leaving air will be saturated at the entering air wet bulb temperature which will be the same as the constant spray water temperature. In practice, since no washer is 100% efficient, there will always be a split between the leaving air dry and wet bulb temperatures. Furthermore, in any humidifying process with an air washer, evaporative cooling will take place if the spray water is not heated. Table 1 gives typical evaporative cooling efficiencies or saturating effectiveness (see equation 1) for commercial air washers when humidifying.

The actual performance of an air washer depends upon the following design factors which will be discussed in more detail:

(1) Intimacy of contact between the air and water.
   a. Quantity of water with respect to air (water to air ratio).
   b. Water pressure and size of nozzle orifice (fineness of atomization).

(2) Time of contact between the air and water.
   a. Air velocity.
   b. Length of air travel.

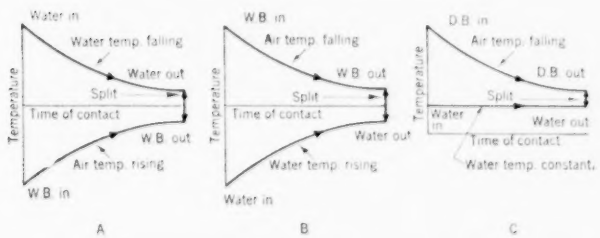

Fig. 2. Behavior of air in contact with water. Heating is shown at A, cooling at B, and evaporative cooling at C.

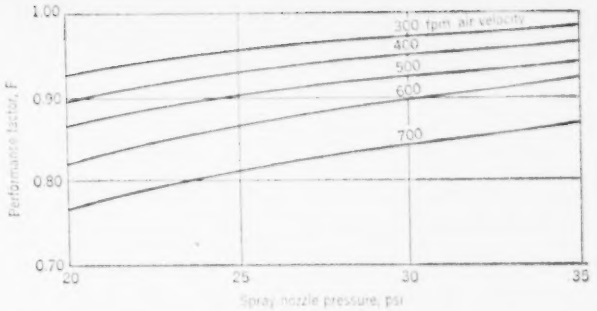

Fig. 3. Typical performance for two-bank spray dehumidifiers. Opposing spray banks are 8 ft long; 3 gpm per sq ft face area per spray bank; nozzles with 3/16 inch dia orifice.

   c. Number of spray banks.
   d. Direction of spray with respect to air flow.

(3) Air conditions.
   a. Entering dry bulb, wet bulb and dew point temperatures.
   b. Required leaving dry bulb, wet bulb and dew point temperatures.

(4) Water conditions.
   a. Entering temperature.
   b. Leaving temperature.
   c. Temperature range.

Theory Involved

In a theoretically perfect air washer, the air leaving will be saturated at the leaving water temperature, since the flow of air and water are essentially concurrent. Therefore, by the first law of thermodynamics, if there are no losses, the enthalpy change of the water must equal the enthalpy change of the air. Thus the state point of the air leaving the 100% perfect air washer may be located on the saturation curve on the psychrometric chart. The entering air state point can also be located on the psychrometric chart. The straight line joining the two points will be fairly close to the path of the thermodynamic change of the air as it goes through the washer. The actual process is difficult to show exactly on the psychrometric chart as the path varies with the washer design characteristics. A slightly curved line is probably more nearly correct, but the straight line analysis will give sufficiently close results for most commercial air conditioning applications. The spray water conditions may be represented by points on the saturation curve. With these limitations in mind, one can reasonably analyze the performance of an air washer on the psychrometric chart in much the same manner as surface cooling coil performance is commonly analyzed in current literature on refrigeration applications.

TABLE 1—EVAPORATIVE COOLING EFFICIENCY
(Saturating Effectiveness)

No. of Spray Banks	Direction of Water Spray	Length of Washer, Ft	Efficiency or Effectiveness, %
1	With air flow	4	50 to 60
1	With air flow	6	60 to 75
1	Against air flow	6	65 to 80
2	With air flow	8 to 10	80 to 90
2	Opposing each other	8 to 10	85 to 95
2	Against air flow	8 to 10	90 to 98

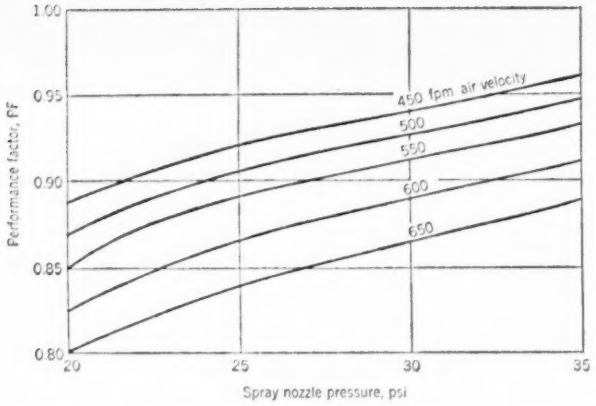

Fig. 4. Typical performance of two-bank spray air washers. Opposing spray banks 8 ft long. Based on American Blower Corp. class 8 air washers.

If the performance of the actual washer in relation to the 100% perfect washer (for any of the characteristics plotted on the psychrometric chart) is obtainable from manufacturers' catalogs or trade literature, then the actual process can also be pictured in the psychrometric chart. The only difficulty is that seldom do manufacturers give such data in their catalogs, and those that do often disagree as to the definition of performance.

The most universally accepted definition for air washer performance is the formula:

$$E = \frac{t_e - t_l}{t_e - t_{wb}}, \text{ where} \qquad (1)$$

E = saturating effectiveness ratio
t_e = dry bulb temperature of entering air, F
t_l = dry bulb temperature of leaving air, F
t_{wb} = wet bulb temperature of entering air, F

This formula applies only for evaporative cooling when the wet bulb temperature of the air remains constant during the process and the spray water is neither heated nor cooled. The term E is often called evaporating cooling efficiency, since E multiplied by the wet bulb depression (dry bulb temperature—wet bulb temperature of entering air) gives the actual dry bulb cooling range of the washer. Typical saturating or evaporative cooling efficiencies for various types of air conditioning washers are given in Table 1.

To cover the entire field of air washer performance, one must have efficiency factors for processes in which the wet bulb temperature of the air changes. Several manufacturers publish data on performance factors for air washers when cooling and dehumidifying, but there is some disagreement among them as to the definition of performance factor.

One manufacturer (1,6)* defines performance factor with the following equation which is that adopted by the National Association of Fan Manufacturers (bulletin 107):

$$F = 1 - \frac{t'_{wb} - t'_w}{t_{wb} - t_w}, \text{ where} \qquad (2)$$

F = performance factor
t_{wb} = wet bulb temperature of entering air
t'_{wb} = wet bulb temperature of leaving air
t_w = entering water temperature
t'_w = leaving water temperature

It can readily be seen from the foregoing equation that for a perfect washer cooling the air to a saturated condition at the leaving water temperature ($t'_{wb} = t'_w$), the performance factor F will be 1.00 or unity. Figure 3 gives typical values for F for two-bank spray dehumidifiers.

Probably a more logical way of looking at performance factor, when the total heat content of the air changes, is to use the ratio of the actual enthalpy change of the air to the enthalpy change that would occur with a theoretically perfect washer. This ratio would represent actual work done, divided by theoretical work from a perfect air washer. Thus one manufacturer (4) defines performance factor as follows:

$$PF = \frac{h_1 - h_2}{h_1 - h_3}, \text{ where} \qquad (3)$$

PF = performance factor
h_1 = enthalpy at entering air wet bulb temperature
h_2 = enthalpy at leaving air wet bulb temperature under actual conditions
h_3 = enthalpy at leaving air wet bulb temperature from theoretically perfect washer (at apparatus dew point)

In other words, in this definition, performance factor, *PF*, is the ratio of the heat actually removed to the heat that would be removed by a theoretically perfect washer with the air leaving 100% saturated at the leaving water temperature. Figures 4 and 5 give typical values of *PF* for both the single and double spray bank air conditioning washers.

Construction and Design Characteristics

For illustrations showing both design and construction characteristics, see Fig. 13 and 14.

Spray Chamber. As used in air conditioning work, a washer consists of a spray chamber having a galvanized steel casing enclosing a specially designed spray water system. The air washer tank or pan is usually of heavier steel than the casing, and is protected from corrosion by a special asphaltic base paint or enamel. These coatings have generally been effective.

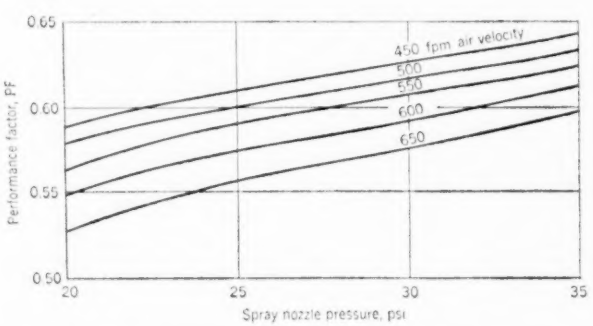

Fig. 5. Typical performance of a single bank spray air washer. Six-foot long sprays with air flow. Based on American Blower Corp. class 6 air washers.

*Numbers in parenthesis refer to bibliography at end of article unless otherwise indicated.

Air Flow. The flow of air is horizontal. The length of air travel varies from a minimum of 4 ft in a single spray bank washer to 8 or 10 ft in a two-bank spray washer. Since uniform air flow through the washer casing is essential for good performance, galvanized horizontal inlet louvers or perforated distribution plates are normally furnished across the inlet face of the air washer. Across the outlet face, vertical eliminator plates of galvanized steel spaced approximately one inch apart are provided for removing any entrained moisture which might otherwise deposit on the ductwork. Some eliminator plates are four bend, but normally plates having six bends at about 30 deg to the direction of air flow are used. The first three faces are usually flat, with hooks or projecting lips on the leaving edges of the last three faces to better catch and remove the entrained moisture.

The best air velocity across the face area of the spray chamber is about 500 fpm (limits from 450 to 650 fpm). Most manufacturers' rating tables are based on 500 fpm air velocity. Unless conditions are ideal, velocities higher than 500 fpm will often result in moisture carrying through the eliminators and into the ductwork. Air friction drop through air washers will vary from 0.20 to 0.30 inch of water for a single bank washer at 450 fpm velocity, to about 0.60 inch of water with a 2-bank washer at 650 fpm velocity.

Water Sprays. Flooding nozzles are sometimes provided near the top on the inlet side of the eliminator plates to provide additional air cleaning using the eliminator plates as contact surfaces for entraining dirt particles. These flooding nozzles are not considered in calculating the thermodynamic efficiencies of an air washer. The nozzles considered are the main bank or banks of centrifugal spray nozzles especially designed for high saturating efficiencies. Figure 7 gives capacities of three sizes of typical spray nozzles for air conditioning work at water pressures from 20 to 35 psi. For a given water capacity, smaller nozzles require higher spray pressures but the resulting spray will be more finely divided and the resulting saturating efficiency higher, other factors being equal. However, the smaller the orifice, the more the trouble from plugged nozzles. Effective strainers in the piping

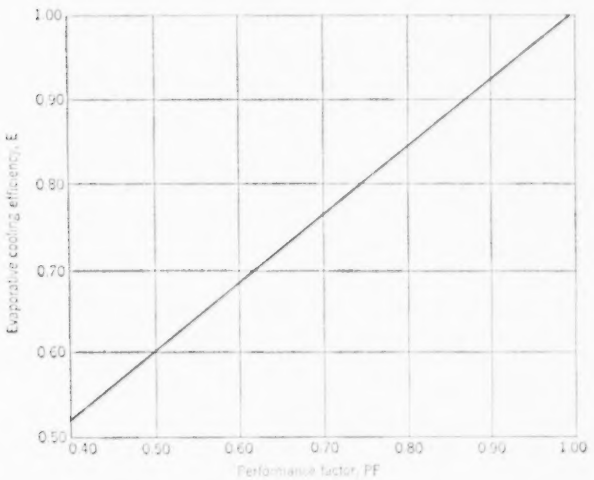

Fig. 6. Evaporative cooling efficiency vs. performance factor, for typical 6 and 8 ft air washers with minimum 20 gpm spray water per sq ft face area per spray bank. Based on American Blower Corp. class 6 and 8 air washers.

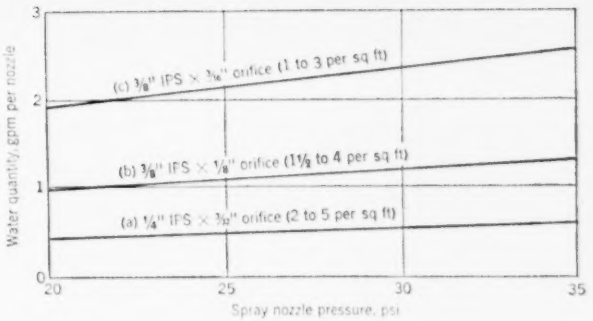
3
2
1
0
Water quantity, gpm per nozzle
(c) 3/8" IPS × 3/16" orifice (1 to 3 per sq ft)
(b) 3/8" IPS × 1/8" orifice (1½ to 4 per sq ft)
(a) 1/4" IPS × 3/32" orifice (2 to 5 per sq ft)
20
25
30
35
Spray nozzle pressure, psi

Fig. 7. Typical spray nozzle performance.

ahead of the nozzles are necessary to prevent frequent stoppage of the nozzles.

For the highest saturating efficiencies, 95% and higher, as when designing for humidification essentially, the smallest size nozzle from Fig. 7 would be used at around 30 psi pressure. This would be nozzle *a*, 1/4 inch IPS × 3/32 inch orifice, rated at 0.55 gpm at 30 psi pressure. The nozzles would be arranged from about two to a maximum of five nozzles per square foot of face area per spray bank. This results in spraying from 1 to 3 gpm per sq ft of face area per spray bank; or with a 2-bank washer, 2 to 6 gpm total per sq ft of face area.

For ordinary ventilation work, a larger nozzle less subject to plugging would normally be used. Nozzle *b*, 3/8 inch IPS × 1/8 inch orifice, is typical of the type water nozzle upon which catalog ratings of most air washers are based. These nozzles are arranged from about 1½ to a maximum of 4 nozzles per square foot of face area per spray bank. This results in spraying from 1½ to 4 gpm per sq ft of face area per spray bank; or with a 2-bank washer, from 3 to 8 gpm total per sq ft of face area.

When designing a washer for cooling and dehumidifying, larger water quantities are required than for other applications. Therefore it often becomes necessary to use a larger nozzle, such as nozzle *c*, 3/8 inch IPS × 3/16 inch orifice, to handle the required quantity of water. These larger nozzles would be arranged from about one to a maximum of three per square foot of face area per spray bank. This results in spraying from 2 to 6 gpm per sq. ft of face area per spray bank; or with a 2-bank washer, from 4 to 12 gpm total per sq ft face area. However, tests have shown that not much is gained by spraying more than 5 gpm per sq ft of face area per spray bank, so 10 gpm total per sq ft face area should be considered the economical maximum for a 2-spray bank washer. The nozzle pressures used vary from 15 to 35 psi resulting in pump head requirements of from 40 to 120 ft, including normal pipe friction and also the static head.

DESIGN AND PERFORMANCE CALCULATIONS

Evaporative Cooling

Evaporative cooling is shown as the cooling and humidifying path 1-C in Fig. 1.

The simplest air washer problem to solve is the process involving evaporative cooling only. The solution to the following typical problem will be graphically illustrated on the psychrometric chart of Fig. 8.

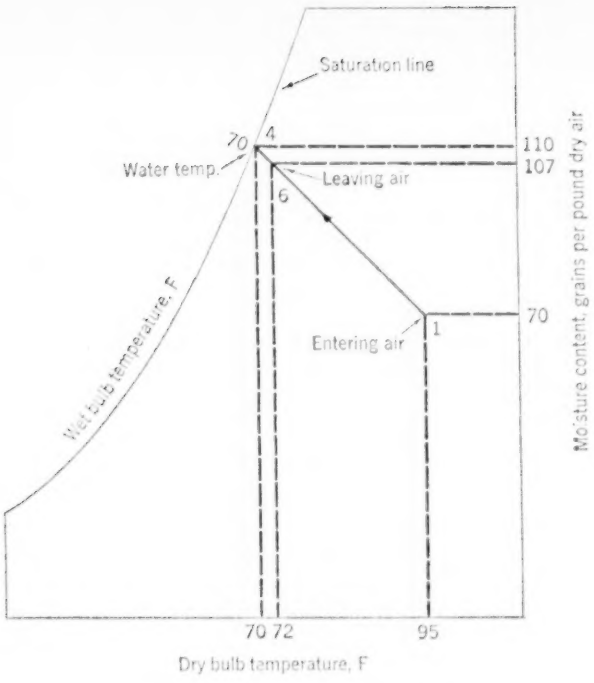

Fig. 8. Evaporative cooling example.

Required 60,000 cfm at 72F DB temperature by evaporative cooling.
Outside air conditions: 95F DB and 70F WB entering washer.

The entering air state point is located at point 1 on Fig. 8. Since the wet bulb temperature of the air will not change during the adiabatic cooling process, the leaving air condition will be located at point 6 on the 70F WB line (line 1-4) at the required 72F DB temperature. The leaving air conditions can be read from the psychrometric chart as 72F DB, 70F WB, 69F DP and 90% RH. The spray water temperature reaches an equilibrium with the wet bulb temperature and remains constant at 70F as indicated by point 4.

From the equation (1):

$$E = \frac{t_e - t_l}{t_e - t_{wb}} = \frac{95 - 72}{95 - 70} = \frac{23}{25} = 0.92$$

From Table 1, it can be seen that a single spray bank washer will not provide the necessary saturating efficiency. A two-bank washer, with opposing spray banks and about 8 ft long will give the required efficiency when handling about 2 gpm per sq ft of face area per spray bank. It normally does not improve the evaporative cooling efficiency to spray more than 2 gpm per sq ft face area per spray bank, or 4 gpm total per sq ft with 2-bank sprays. The medium sized *b*-nozzles (⅜ inch IPS × ⅛ inch orifice) would be used at 25 to 30 psi pressure.

A somewhat closer selection may be made using the curves of Fig. 4, 5 and 6 derived from the published data of one of the leading manufacturers of air washers. This manufacturer (4) relates saturating efficiency *E* to performance factor *PF* in Fig. 6. From this curve, at the required 92% saturating efficiency, the performance factor is 0.90. Using Fig. 4 for a two-bank spray washer, we find that a *PF* of 0.90 is obtained at 500 fpm air velocity and 24 psi spray pressure.

Since air washers are rated at standard air conditions (70F DB, 29.92 inches, Hg barometer, and specific volume of 13.35 cu ft per lb), the air quantity should be corrected to standard air before selecting the washer. In this problem the requirements are 60,000 cfm at the air washer outlet conditions of 72F DB, 70F WB, 90% RH and specific volume = 13.72 cu ft per lb.

$$\text{Standard cfm} = \frac{(13.35)}{(13.72)}\ (60{,}000) = 58{,}200 \text{ cfm}$$

$$\text{Washer face area} = \frac{58{,}200 \text{ cfm}}{500 \text{ fpm vel.}} = 116.4 \text{ sq ft}$$

Use *b*-nozzle size, ⅜ inch IPS × ⅛ inch orifice, spray nozzles and 1½ to 2 gpm per sq ft face area per spray bank. From Fig. 7 at 24 psi spray pressure, each nozzle handles 1.07 gpm.

$$(116.4 \text{ sq ft})\ (2 \text{ gpm per sq ft})\ (2 \text{ spray banks}) = \frac{466 \text{ gpm}}{1.07 \text{ gpm per nozzle}} = 436 \text{ nozzles, or } 218 \text{ nozzles per spray bank.}$$

It will usually be found that air washer rating tables will be based on the correct number of nozzles and water quantity for effective evaporative cooling, in this case from 350 to 466 gpm for two-spray banks.

Cooling with Well Water

If a constant supply of cold well water is available, it is often economically feasible to air condition with 100% outside air, cooling the air down to supply air conditions in an air washer. With dry outside air, the process will be in the general direction of the cooling and dehumidifying path 1-C of Fig. 1. Consider the following problem for which the solution is shown on the psychrometric chart of Fig 9.

The calculated cooling load is composed of the following factors:

(1) Room sensible load = Q_s = 530,000 Btu per hr = 44.1 tons refrigeration
(2) Room latent load = Q_L = 330,000 Btu per hr = 27.5 tons refrigeration
(1) + (2) = room total load = Q_T = 860,000 Btu per hr = 71.6 tons refrigeration
Room sensible heat factor = Room SHF = $\frac{Q_s}{Q_T} = \frac{530{,}000}{860{,}000} = 0.617$
Outside air conditions: 105F DB and 70F WB entering washer
Room air conditions: 80F DB, 68F WB and 55% RH
Well water temperature = 50F

The supply air temperature should be from 8 to 15 F higher than the entering well water temperature, and a set of cut and try calculations may be necessary to determine the proper supply air condition. In this case 62F DB supply air with 50F entering well water will be about right.

This problem is solved by plotting the room load ratio line 2-5 on Fig. 9, together with the path of the supply air, in much the same manner as a surface cooling coil problem is analyzed on the psychrometric chart. First locate state point 2 of the room air. Then draw the room load ratio line 2-5 through point 2 and parallel to the sensible heat factor guide line for Room SHF = 0.617. The indicated apparatus dew point at point 5 on the saturation curve is 50F.

If the psychrometric chart does not have sensible heat factor guide lines, the slope of the line 2-5 can easily be calculated since the abscissa on the chart is dry bulb temperature and the ordinate is normally moisture content in grains per pound of dry air.

$$\text{Room } Q_s = \frac{(\text{cfm})\ (0.24)\ (60)\ (t_r - t_s)}{13.35} = (\text{cfm})\ (1.08)\ (t_r - t_s) \qquad (4)$$

where Q_s = Btu per hr sensible load
t_s = DB temperature of supply air
t_r = DB temperature of room air
0.24 = specific heat of air
13.35 = specific volume, cu ft per lb

$$\text{Room } Q_L = \frac{(\text{cfm})\ (60)\ (1060)\ (G_r - G_s)}{(13.35)\ (7000)} = (\text{cfm})\ (0.68)\ (G_r - G_s) \qquad (5)$$

where Q_L = Btu per hr latent load
G_s = grains moisture per pound of supply air
G_r = grains moisture per pound of room air
7000 = grains moisture per pound of supply air
1060 = Btu to condense 1 lb of moisture

Therefore, using equations (4) and (5):

$$\text{Room } Q_s = (\text{cfm})\ (1.08)\ (t_r - t_s)$$
$$530{,}000 = (\text{cfm})\ (1.08)\ (80 - 62)$$
$$\text{cfm} = \frac{530{,}000}{(1.08)\ (18)} = 27{,}200$$
$$\text{Room } Q_L = (\text{cfm})\ (0.68)\ (G_r - G_s) = 330{,}000$$
G_r = 84 at 80F DB and 63F WB
cfm = 27,200
$$330{,}000 = (27{,}200)\ (0.68)\ (84 - G_s)$$
$$84 - G_s = \frac{330{,}000}{(27{,}200)\ (0.68)} = 18$$
$$G_s = 84 - 18 = 66$$

State point 6 of the air entering the room can now be located at 62F DB and 66 grains per pound of dry air, thus determining the slope of the room load ratio line 2-6-5 intersecting the saturation curve at an indicated apparatus dew point of 50F, which merely by coincidence happens to be the entering water temperature. At state point 6, the dew point is 55.5F which will have to be the leaving spray water temperature if the air leaving the washer is to be cooled to 62F DB with a moisture content of 66 gr per lb.

Locate the washer entering air state point 1 at 105F DB and 70F WB. The entering air can be considered as evaporative cooling from points 1 to 7 on the 70F WB

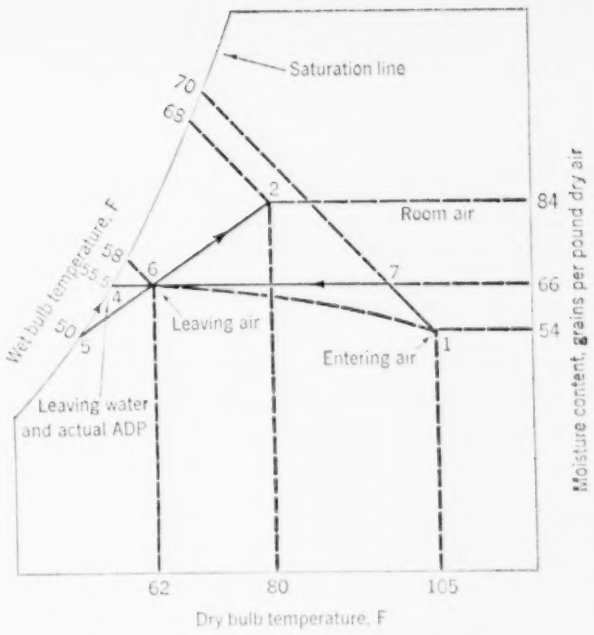

Fig. 9. Cooling example using well water.

line, and then sensibly cooling along the horizontal line 7-4 at constant 55.5F DP toward point 4 on the saturation curve. The actual apparatus dew point (or leaving spray water temperature) will be 55.5F at point 4 on the saturation curve. The actual path from state point 1 entering to state point 6 leaving the washer will probably be along the curved, dashed line from 1 to 6, depending upon the washer design characteristics, but the path 1-7-6 is close enough for analysis purpose.

The air washer should be selected for 500 fpm face velocity at 27,200 cfm, which has already been calculated for standard air conditions.

$$\frac{27{,}200 \text{ cfm}}{500 \text{ fpm vel.}} = 54.4 \text{ sq ft face area}$$

The spray water quantity must be such that it absorbs the total cooling load when rising in temperature from 50 to 55.5F. Only the room load has been given, so the total load including the outside air must be calculated. Knowing the entering and leaving air conditions for the air washer, and the air quantity required, this is readily done by means of equations (4) and (5).

Overall Q_s = (cfm) (1.08) ($t_o - t_s$)
t_o = 105F DB outside air entering washer
t_s = 62F DB supply air leaving washer
Overall Q_s = (27,200) (1.08) (105 − 62) = 1,263,000 Btu per hr = 105.3 tons refrig.
Overall Q_L = (cfm) (0.68) ($G_o - G_s$)
G_o = 54 grains per lb moisture in outside air
G_s = 66 grains per lb moisture in supply air
Overall Q_L = (27,200) (0.68) (54 − 66) = −222,000 Btu per hr = −18.5 tons refrig.

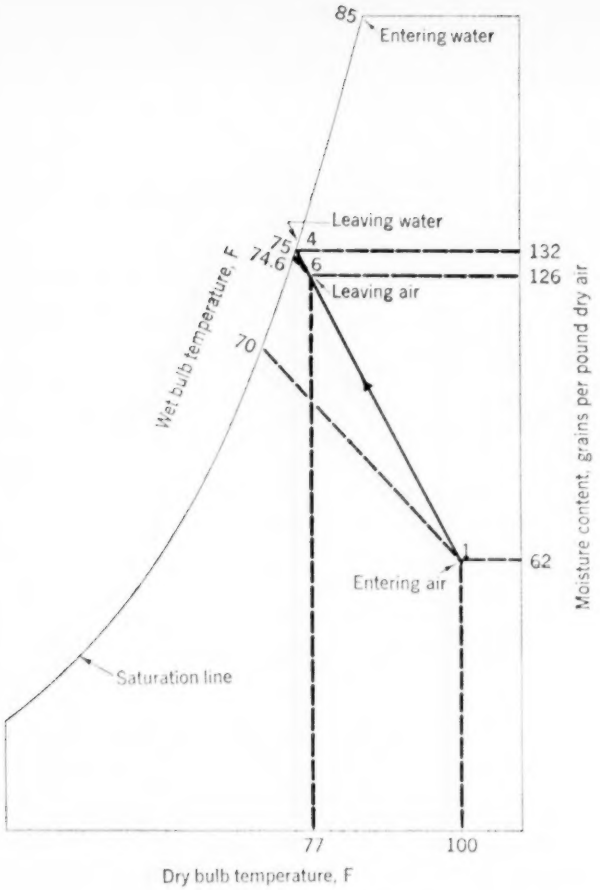

Fig. 10. Water cooling example.

$$\text{Overall } Q_T = 1{,}263{,}000 - 222{,}000 = 1{,}041{,}000 \text{ Btu per hr} = 86.8 \text{ tons refrig.}$$

From the heat balance equation: (6)

(Heat absorbed by water) = (Heat removed from air)

we obtain the following relationship:

$$(\text{gpm})\ (60)\ (8\tfrac{1}{3})\ (t_l - t_e) = \text{Overall } H_T$$

where t_e = temperature of water entering washer

t_l = temperature of water leaving washer

$$(\text{gpm})\ (60)\ (8\tfrac{1}{3})\ (55.5 - 50) = 1{,}041{,}000 \text{ Btu per hr}$$

$$\text{gpm} = \frac{1{,}041{,}000}{(500)\ (5.5)} = 380$$

$$\frac{380 \text{ gpm}}{54.4 \text{ sq ft face area}} = 7 \text{ gpm per sq ft}$$

Use 2-bank spray at $3\tfrac{1}{2}$ gpm per sq ft per spray bank. A 100% perfect air washer would cool from 70F WB to 55.5F ADP.

Enthalpy at 70F WB	= 34.09 Btu per lb
Enthalpy at 55.5 ADP	= 23.53 Btu per lb
Enthalpy removed	= 10.56 Btu per lb by perfect washer

Actual washer cools from 70F WB to 58F WB at state point 7.

Enthalpy at 70F WB	= 34.09 Btu per lb
Enthalpy at 58F WB	= 25.12 Btu per lb
Enthalpy removed	= 8.97 Btu per lb by actual washer

From equation (3)

$$\text{Required PF} = \frac{8.97}{10.56} = 0.85$$

From Fig. 4 at 500 fpm air velocity and 20 psi spray pressure, a 2-bank washer has a performance factor (PF) of 0.87 which is satisfactory. From Fig. 7 at 20 psi pressure, type *c*-nozzles ($\frac{3}{8}$ inch IPS × $\frac{3}{16}$ inch orifice) handle 1.94 gpm each.

$$\frac{380 \text{ gpm}}{1.94 \text{ gpm per nozzle}} = 196 \text{ nozzles total, or } 98 \text{ per spray bank}$$

$$\frac{98 \text{ nozzles}}{54.4 \text{ sq ft face area}} = 1.8 \text{ nozzles per square foot face area per spray bank}$$

Check by equation (2):

$$F = 1 - \frac{t'_{wb} - t'_w}{t_{wb} - t_w} = 1 - \frac{58 - 55.5}{70 - 50} = 1 - \frac{2.5}{20}$$

$$F = 1 - 0.125 = 0.875$$

From Fig. 3 at 500 fpm air velocity and 21 psi spray pressure, a 2-bank dehumidifier has a performance factor *F* of 0.875 which is required. From Fig. 7 at 21 psi pressure, type *c*-nozzles ($\frac{3}{8}$ inch IPS × $\frac{3}{16}$ inch orifice) handle 2 gpm each.

$$\frac{380 \text{ gpm}}{2 \text{ gpm per nozzle}} = 190 \text{ nozzles total, or } 95 \text{ per spray bank}$$

$$\frac{95 \text{ nozzles}}{54.4 \text{ sq ft face area}} = 1.75 \text{ nozzles per square foot face area per spray bank}$$

Water Cooling

In Fig. 1, this cooling and humididying process is illustrated by path 1-C.

Air washers may be used for water cooling instead of for air cooling. A typical problem would be for an air washer to serve as a cooling tower under the following operating conditions:

Required to cool 300 gpm from 85F to 75F.

Outside air conditions: 100F DB and 70F WB entering washer.

If we select a two-bank spray washer, from Fig. 4 we obtain a performance factor of 0.925 at 500 fpm air velocity and 30 psi spray pressure.

Referring to the psychrometric chart of Fig. 10, a 100% perfect washer would cool the water from 85 to 75F while the air was cooling from 100F DB and 70F WB at state point 1 to 75F saturated at point 4 on the saturation curve.

From the heat balance equation (6):

(Heat removed from water) = (Heat absorbed by air)

$$(300 \text{ gpm})\ (60)\ (8\tfrac{1}{3})\ (85-75) = Q_T$$
$$= 1{,}500{,}000 \text{ Btu per hr}$$
$$= 25{,}000 \text{ Btu per min}$$

A theoretically perfect washer would effect 100% heat transfer from 70 to 75F WB.

Enthalpy at 75F WB = 38.61 Btu per lb
Enthalpy at 70F WB = 34.09 Btu per lb
Enthalpy absorbed = $\triangle h$ = 4.52 Btu per lb by perfect washer

Enthalpy which will be removed by an actual washer at 0.925 *PF* = (0.925) (4.52) = 4.18 Btu per lb.

Air leaving the washer will be at state point 6, corresponding to an enthalpy of 34.09 + 4.18 = 38.27 Btu per lb or 74.6F WB, 77F DB and 90% RH.

Actual air requirement =

$$\frac{Q_T}{\triangle h} = \frac{25{,}000 \text{ Btu per min}}{4.18 \text{ Btu per lb}} = 6000 \text{ lb per min}$$

Select washer on standard air basis at 500 fpm air velocity and 30 psi spray pressure.

$$\text{cfm} = (6{,}000)\ (13.35 \text{ cu ft per lb}) = 80{,}000$$

$$\frac{80{,}000 \text{ cfm}}{500 \text{ fpm vel.}} = 160 \text{ sq ft face area}$$

$$\frac{300 \text{ gpm}}{160 \text{ sq ft face area}} = 1.88 \text{ gpm per sq ft face area}$$

$$\frac{1.88 \text{ gpm per sq ft}}{2 \text{ spray banks}} = 0.94 \text{ gpm per sq ft face area per spray bank}$$

For this small water quantity per square foot, size *a*-nozzles (¼ inch IPS × 3/32 inch orifice) should be used. At 30 psi from Fig. 7, these nozzles handle 0.55 gpm each.

$$\frac{300 \text{ gpm}}{0.55} = 546 \text{ nozzles total, or } 273 \text{ nozzles per spray bank}$$

$$\frac{273 \text{ nozzles}}{160 \text{ sq ft face area}} = 1.7 \text{ nozzles per sq ft face area per spray bank}$$

The actual fan cfm at the air washer outlet conditions for state point 6 where the air has a specific volume of 13.92 cu ft per lb will then be:

$$(6{,}000 \text{ lb per min})\ (13.92) = 83{,}500 \text{ cfm}$$

Cooling and Dehumidifying

The cooling and dehumidifying step is shown in Fig. 1 as path 1-A.

When the process requires cooling and dehumidification of the air, larger water quantities than manufacturers' catalogs usually indicate are required. The reason for the large water quantity can readily be seen when we consider a few of the approximations which are applicable to the average air conditioning job. First, it is good engineering to supply approximately 250 cfm of dehumidified air per ton of refrigeration capacity. Thus at 500 fpm recommended air velocity, a washer should handle 2 tons

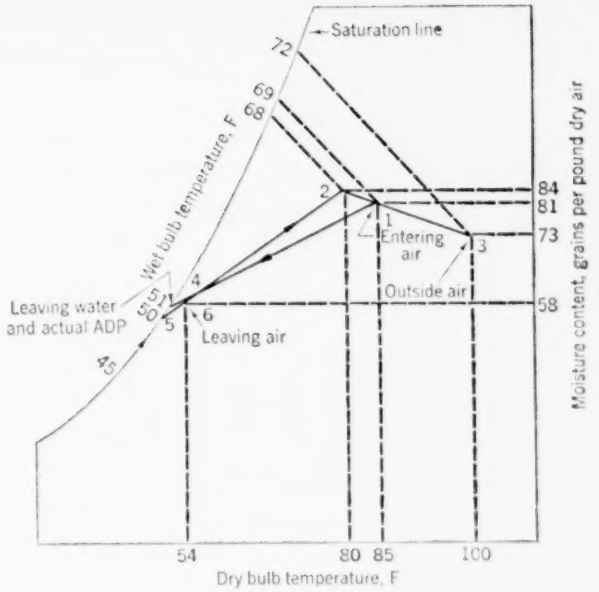

Fig. 11. Cooling and dehumidifying example.

refrigeration capacity per square foot of face area. Another good rule is to design for a water range of 5 to 10F with 7F range about average. Since

$$\frac{(\text{gpm})\ (8\tfrac{1}{3})\ (\text{temp. range deg.})}{200} = \frac{(\text{gpm})\ (\text{degrees})}{24} =$$

tons refrigeration capacity.

Therefore a 5 to 10F water temperature range represents a water consumption rate of 4.8 to 2.4 gals per minute per ton, or for round figures a water quantity of 2½ to 5 gpm per ton. Based on 2 tons per sq ft of face area, we should then require from 5 to 10 gal of water sprayed per square foot of face area; or if we use two-bank sprays, from 3 to 5 gpm per sq ft face area per spray bank. Air washer manufacturers ordinarily show much less water than this in their catalogs, usually only from 1½ to 2 gpm per sq ft of face area per spray bank. It does not seem to improve the efficiency appreciably to spray more than 5 gpm per sq ft of face area per spray bank, so the economical maximum for a two-bank washer is about 10 gpm total per sq ft of face area.

The solution of a typical cooling and dehumidifying problem, with the *room cooling load* the same as in the foregoing problem involving *cooling with well water*, is indicated on the psychrometric chart of Fig. 11.

The calculated cooling load is composed of the following factors:

(1) Room sensible load = Q_s = 330,000 Btu per hr = 44.1 tons refrig.
(2) Room latent load = Q_L = 330,000 Btu per hr = 27.5 tons refrig.
(1) + (2) Room total load = Q_T = 360,000 Btu per hr = 71.6 tons refrig. sensible heat factor:

$$\text{Room SHF} = \frac{Q_s}{Q_T} = \frac{330{,}000}{360{,}000} = 0.917$$

Outside air conditions: 100F DB and 72F WB.
Room air conditions: 80F DB, 63F WB and 55% RH.

Supply air to be 26F below room temperature or 80F − 26F = 54F.
Recirculated air = 75%; outside air = 25%.

First plot the room load ratio line 2-5 in Fig. 11 in the same manner as it was done on Fig. 9, from the Room SHF = 0.617. If the psychrometric chart does not have sensible heat factor guide lines, the slope of 2-5 can be calculated using equations (4) and (5).

$$\text{Room } Q_s = (\text{cfm})\ (1.08)\ (t_r - t_s)$$
$$530{,}000 = (\text{cfm})\ (1.08)\ (80 - 54)$$
$$\text{cfm} = \frac{530{,}000}{(1.08)\ (26)} = 18{,}900$$
$$\text{Room } Q_L = (\text{cfm})\ (0.68)\ (G_r - G_s)$$
G_r = 84 gr per lb in room air at 80F DB and 63F WB
$$330{,}000 = (18{,}900)\ (0.68)\ (84 - G_s)$$
$$84 - G_s = \frac{330{,}000}{(18{,}900)\ (0.68)} = 26$$
$$G_s = 84 - 26 = 58 \text{ gr per lb in supply air}$$

First locate state point 2 at the room conditions of 80F DB and 63F WB (84 gr per lb). State point 6 of the air entering the room can then be located at 54F DB and 58 gr per lb of dry air, thus determining the slope of the room load ratio line 2-6-5 which intersects the saturation curve at the indicated ADP of 50F. Next locate the outside air conditions of 100F DB and 72F WB at point 3. The air entering the washer will be a mixture of 25% outside air and 75% recirculated air, and will fall on the straight line joining 2 and 3. By proportion, state point 1 of the mixed air entering the washer can be located on line 2-3 at $\frac{100 + (3)\ (80)}{4}$ = 85F DB temperature.

The line 1-6 then represents the required performance of the washer in absorbing the outside air as well as the room cooling load. The intersection of line 1-6 extended to point 4 on the saturation curve is the required apparatus dew point at 51F. Line 6-2 represents the path of the air as it enters the room at point 6 and warms up by absorbing the room sensible and latent heat loads until the room condition at point 2 is reached.

The total cooling load is that required to cool the supply air quantity from state point 1 entering the washer to state point 6 leaving the washer and entering the room.

Using equations (4) and (5):

$$\text{Overall } Q_s = (\text{cfm})\ (1.08)\ (t_e - t_s)$$
t_e = 85F DB entering washer
t_s = 54F DB supply air (leaving washer)
$$\text{Overall } Q_s = (18{,}900)\ (1.08)\ (85 - 54) = 635{,}000$$
Btu per hr = 52.8 tons refrig.
$$\text{Overall } Q_L = (\text{cfm})\ (0.68)\ (G_e - G_s)$$
G_e = 81 gr per lb at 85F DB and 69F WB entering washer.
G_s = 58 gr per lb at 54F DB and 53F supply air.
$$\text{Overall } Q_L = (18{,}900)\ (0.68)\ (81 - 58) = 296{,}000$$
Btu per hr = 24.7 tons refrig.
$$\text{Overall } Q_T = 635{,}000 + 296{,}000 = 931{,}000 \text{ Btu per hr} = 77.5 \text{ tons refrig.}$$

$$\text{Overall } \frac{Q_s}{Q_T} = \frac{635{,}000}{931{,}000} = 0.68$$

The air washer must provide air at state point 6 having conditions of 54F DB, 53F WB, 52F DP, 93% RH. The leaving spray water temperature will be 51F, the actual apparatus dew point. A perfect washer would cool from state point 1 entering to saturation at state point 4, the actual ADP.

h_1 = enthalpy of entering air at 69F WB = 33.25 Btu per lb
h_2 = enthalpy of leaving air at 53F WB = 22.02 Btu per lb
h_3 = enthalpy of air at 51F ADP = 20.86 Btu per lb

From equation (3):

$$\text{Required PF} = \frac{h_1 - h_2}{h_1 - h_3} = \frac{33.25 - 22.02}{33.25 - 20.86} = \frac{11.23}{12.39} = 0.91$$

Select two-bank spray washer from Fig. 4 at 500 fpm air velocity and 26 psi spray pressure = 0.91 PF.

$$\frac{18{,}900 \text{ cfm}}{500 \text{ fpm vel.}} = 37.8 \text{ sq ft face area required in washer.}$$

Spray water temperature range should be from 5 to 10F in a dehumidifier, say 6F in this case. Therefore, spray water should enter washer at 45F and leave at 51F.

From heat balance equation (6):

(Heat removed from water) = (Heat absorbed by air)
$$(\text{gpm})\ (60)\ (8\tfrac{1}{3})\ (51 - 45) = Q_T = 931{,}000 \text{ Btu per hr}$$
$$\text{Required gpm} = \frac{931{,}000}{(500)\ (6)} = 310$$

$$\frac{310 \text{ gpm}}{37.8 \text{ sq ft face area}} = 8.2 \text{ gpm per sq ft face area}$$

$$\frac{8.2 \text{ gpm per sq ft}}{2 \text{ spray banks}} = 4.1 \text{ per sq ft face area per spray bank}$$

For this large quantity of water per square foot, size *c*-nozzles ($\frac{3}{8}$ inch IPS × $\frac{3}{16}$ inch orifice) should be used. At 26 psi from Fig. 7, these nozzles handle 2.2 gpm each.

$$\frac{310 \text{ gpm}}{2.2} = 141 \text{ nozzles total, or say } 71 \text{ nozzles per spray bank}$$

$$\frac{71 \text{ nozzles}}{37.8 \text{ sq ft face area}} = 1.88 \text{ nozzles per sq ft face area per spray bank}$$

The actual fan cfm at supply air conditions for state point 6 where the air has a specific volume of 13.12 cu ft per lb will then be:

$$(18{,}900 \text{ cfm}) \left(\frac{13.12}{13.35}\right) = 18{,}600 \text{ cfm}$$

Check by equation (2):

$$F = 1 - \frac{t'_{wb} - t'_w}{t_{wb} - t_w} = 1 - \frac{53 - 51}{69 - 45} = 1 - \frac{2}{24}$$

$$F = 1 - 0.083 = 0.917$$

From Fig. 3 at 500 fpm air velocity and 27 psi spray pressure, a two-bank spray dehumidifier will give a performance factor F of 0.912. Practically the same number of size *c*-nozzles as selected above for 26 psi pressure would be used in the latter case for 27 psi pressure.

Heating and Humidifying

In Fig. 1, this is shown on path 1-E:

When the washer spray water is heated, higher humidification can be obtained than indicated by the saturating efficiencies in Table 1. The spray water may be heated by a closed shell and tube water heater, or by an ejector water heater mixing steam with the spray water, either located in the spray piping; or by means of steam coils in the washer pan. When the leaving spray water temperature is maintained higher than the entering air dry bulb temperature, both heating and a very high degree of saturation will be obtained. A two-bank spray washer will give practically 100% saturation with heated spray water.

The saturating efficiencies of Table 1 and Fig. 6 apply only when we have adiabatic cooling. The performance factors (PF and F) of Figs. 3 to 6 inclusive apply strictly only when cooling and dehumidification take place. If these relationships are to be applied to a heating and humidifying process using heated spray water, certain liberties must be taken. It seems reasonable to assume that we will obtain a leaving dew point as high as if the air were first heated and then evaporative cooled with spray water at the leaving water temperature. Knowing the leaving air dew point temperature and the general path of the heating and humidifying process, we can locate the state point of the air leaving the washer. Then from the entering and leaving air wet bulb temperatures and the apparatus dew point, the performance factor can be calculated. From Figs. 4, 5 and 6, the air washer operating conditions can then be selected with a fair degree of accuracy.

The following example, analyzed on the psychrometric chart of Fig. 12, illustrates this approximate method for calculating washer performance with heated spray water:

> Required 20,000 cfm at 64F dew point leaving air washer.
> Entering air conditions: 45F DB, 39F WB, 58% RH.
> Leaving spray water temperature 65F.

Locate state point 1 at the washer entering air conditions, and point 4 on the saturation curve at 65F leaving water temperature which will also be the apparatus dew point. The straight line 1-4 will be the approximate path of the process. Actually, depending upon washer design factors, the true path of the process will be more like the dashed line from 1-4, but the straight line will be close enough for analysis purposes.

If the air had first been heated from the entering condition at state point 1 along a constant 31.5F entering dew point line to 107F DB and 65F WB at state point 2, and then evaporative cooled along the constant 65F WB line

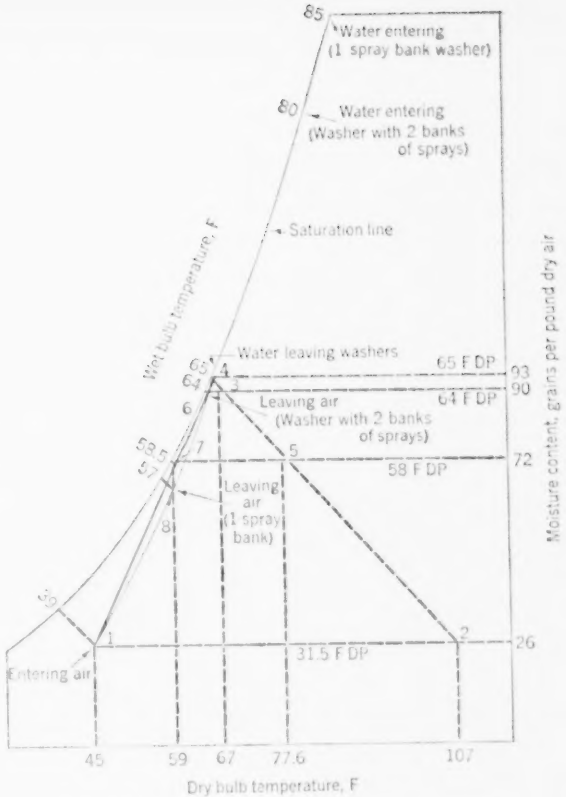

Fig. 12. Heating and humidifying example.

(line 2-4), the evaporative cooling efficiency formula (1) would apply. For 64F leaving dew point temperature at point 3, the leaving dry bulb temperature is 67F and the evaporative cooling efficiency would be:

$$E = \frac{107 - 67}{107 - 65} = \frac{40}{42} = 0.955$$

From Fig. 6, the performance factor *PF*, corresponding to 0.955 evaporative cooling efficiency, is 0.945. The actual washer when heating and humidifying, should have very close to this performance factor. The actual path of the change, however, is along the line 1-4; and the leaving air condition at 64F dew point at state point 6 is practically on the saturation curve at 64F DB, 64F WB, and 100% RH.

> Enthalpy at 65F WB = 30.06 Btu per lb
> Enthalpy at 39F WB = 14.76 Btu per lb
> Enthalpy removed = $\triangle h_1$ =
> 15.30 Btu per lb by perfect washer
> Enthalpy at 64F WB = 29.31 Btu per lb
> Enthalpy at 39F WB = 14.76 Btu per lb
> Required enthalpy removal = $\triangle h_2$ =
> 14.55 Btu per lb by actual washer

$$\text{Actual PF} = \frac{\triangle h_2}{\triangle h_1} = \frac{14.55}{15.30} = 0.95$$

Two Spray Banks. From Fig. 4, a two spray banks washer at 450 fpm and 32 psi spray pressure has a PF = 0.95. For best saturating efficiency, provide 2 gpm per sq ft face area per spray bank. The specific volume

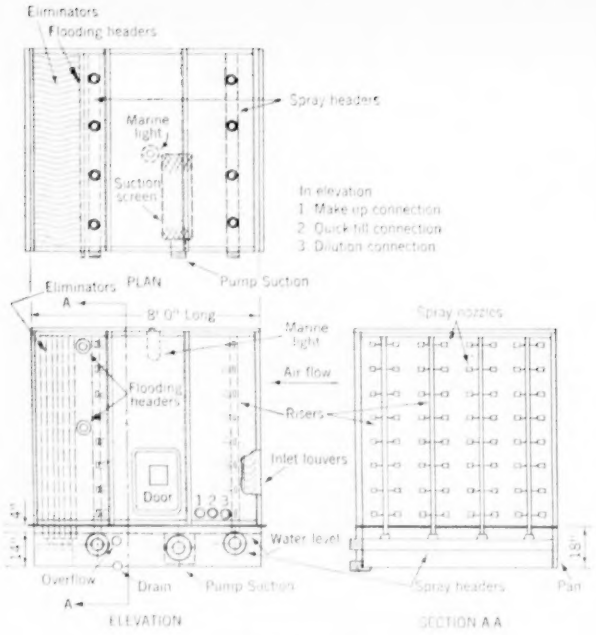

Fig. 13. Typical two-bank spray air washer.

at 64F saturated = 13.65 cu ft per lb for 20,000 cfm.

$$\text{Standard air required} = (20{,}000)\ \frac{(13.35)}{(13.65)} = 19{,}600 \text{ cfm}$$

$$\frac{19{,}600 \text{ cfm}}{450 \text{ fpm vel.}} = 43.5 \text{ sq ft face area required.}$$

(43.5 sq ft) (2 gpm) (2 spray banks) = 174 gpm

Use size *b*-nozzles, $\frac{3}{8}$-inch IPS × $\frac{1}{8}$-inch orifice, each rated at 1.2 gpm at 32 psi pressure, from Fig. 7.

$$\frac{174 \text{ gpm}}{1.2 \text{ gpm per nozzle}} = 145 \text{ nozzles total, or 73 nozzles per spray bank}$$

$$\frac{73 \text{ nozzles}}{43.5 \text{ sq ft face area}} = 1.68 \text{ nozzles per square foot face area per spray bank}$$

From heat balance equation (6):

(Heat given up by water) = (Heat absorbed by air)

$$(\text{gpm})\ (8\tfrac{1}{3})\ \text{temp. range} = \frac{(\text{cfm})}{(\text{sp vol})}\ (\triangle h_2)$$

$$(174)\ (8\tfrac{1}{3})\ (\text{Temp. range}) = \frac{(19{,}600)}{(13.35)}\ (14.55) = 21{,}400$$

$$\text{Temp range} = \frac{21{,}400}{(174)\ (8\text{-}1/3)} = 14.3\text{F, say 15F.}$$

The entering spray water will therefore be 65F + 15F or 80F and the leaving spray water 65F with 64F saturated air leaving the washer.

One Spray Bank. If a single bank spray washer is used instead, under the same operating conditions but with half the water quantity, the performance factor and saturating efficiency would be as follows:

At 450 fpm air velocity and 32 psi spray pressure, from Fig. 5, PF = 0.63. From Fig. 6, obtain the evaporative cooling efficiency E = 0.70.

If, as before, the air had first been heated, in Fig. 12, along line 1-2 to 107F DB, and then evaporative cooled along the line 2-4, the leaving air dry bulb temperature would be calculated from the saturating efficiency, *E*:

$$E = 0.70 = \frac{107 - t_1}{107\text{-}65} = \frac{107 - t_1}{42}$$

$$107\text{-}t_1 = (42)\ (0.70) = 29.4$$

$$t_1 = 107 - 29.4 = 77.6\text{F}$$

Locate state point 5 on line 2-4 at 77.6F DB. This determines the 58F dew point at state point 5, and following along the horizontal 58F dew point line to the intersection with line 1-4, determines the state point 7 leaving the single spray bank washer.

The leaving air conditions are read as 59F DB, 58.5F WB and 97% RH. This relative humidity is probably somewhat high, as the straight line from 1-2 is not the true path, but it will be at least 90%. The performance factor may be checked as follows:

Enthalpy at 65F WB = 30.06 Btu per lb
Ethalpy at 39F WB = 14.76 Btu per lb

Enthalpy removed = $\triangle h_1$ = 15.30 Btu per lb by perfect washer

Enthalpy at 58.5F WB = 25.45 Btu per lb
Enthalpy at 39F WB = 14.76 Btu per lb

Enthalpy removed = $\triangle h_2$ = 10.96 Btu per lb by actual washer.

$$\text{Apparent PF} = \frac{\triangle h_2}{\triangle h_1} = \frac{10.69}{15.30} = 0.70$$

The performance factor of 0.70 thus obtained is higher than the *PF* of 0.63 assumed for the single spray bank washer in the beginning. It here is quite evident that this method of analysis becomes less exact as the final air state point gets further away from the saturation line. In this case with a one spray bank air washer, we might reasonably expect leaving air conditions of 59F DB and 90% RH, corresponding to 57F WB at state point 8 on Fig. 12. The performance factor would then be calculated as follows:

Enthalpy at 57F WB = 24.48 Btu per lb leaving.
Enthalpy at 39F WB = 14.76 Btu per lb entering.

The difference is the enthalpy removed (by actual washer) = $\triangle h'_2$ = 9.72 Btu per lb

$$\text{Actual PF} = \frac{\triangle h'_2}{\triangle h_1} = \frac{9.72}{15.30} = 0.635$$

This compares satisfactorily with the 0.63 PF assumed in the beginning.

From the heat balance equation (6):

(Heat given up by water) = (Heat absorbed by air)

$$(\text{gpm})\ (8\tfrac{1}{3})\ (\text{temp range}) = \frac{(\text{cfm})}{(\text{sp vol})}\ (\triangle h'_2)$$

$$\left(\frac{174}{2}\right)(8\tfrac{1}{3})\ (\text{temp range}) = \frac{(19{,}600)}{(13.35)}\ (9.72)$$

$$= 14{,}300$$

$$\text{Temp range} = \frac{14{,}300}{(87)\ (8\tfrac{1}{3})} = 19.7\text{F, say } 20\text{F.}$$

The entering spray water will then be 65F + 20F or 85F, and the leaving spray water 65F, with 59F DB and 90% RH air leaving the single spray bank washer.

Summary

The psychrometric chart provides a convenient medium for graphically showing air-water thermodynamic processes involving air washers. The first law of thermodynamics gives us an energy balance, that the heat absorbed or rejected by the air equals the heat rejected or absorbed by the water. By using the psychrometric chart and the air-water heat balance, the leaving air and water conditions may be closely approximated if the following data concerning the design of the washer are available:

(1) Saturating efficiency (E) when spray water is neither heated nor cooled.

(2) Performance factor (F or PF) when cooling and dehumidifying (which factor PF may also be applied with reservations when heating and humidifying).

(3) Spray nozzle performance depending upon water pressure and size of orifice.

Related to the above factors are the air velocity, length of air travel, number of spray banks, and direction of water spray with respect to air travel. In general, for air conditioning work the air velocity should be 500 fpm. The spray pressure should be from 20 to 35 psi, with the higher water pressures required for best saturating efficiencies. Centrifugal nozzles should normally be of such size as to handle from 1 to 2½ gpm each at these pressures. Nozzles with the very small 3/32 inch orifices and handling about ½ gpm each are used when an extremely high saturating efficiency is the prime objective.

For ordinary air conditioning work, the spray water quantity should be from 2 to 5 gpm per sq ft of face area per spray bank. Nothing much is gained in evaporating cooling efficiency by spraying more than 2 gpm per sq ft face area per spray bank. Larger water quantities as a rule are required when cooling and dehumidifying, where 3 to 5 gpm per sq ft per spray bank result in the most efficient design. At the higher water rates, larger spray nozzles may be used since more water with a coarser spray gives equivalent performance to less water with a finer spray.

Air conditioning washers vary in length from 4 ft to 10 ft, with the 6 ft washer being the most common for a single bank washer and 8 to 10 ft for a two-bank washer. Uniformity of air velocity over the face area of the washer is most important to proper performance.

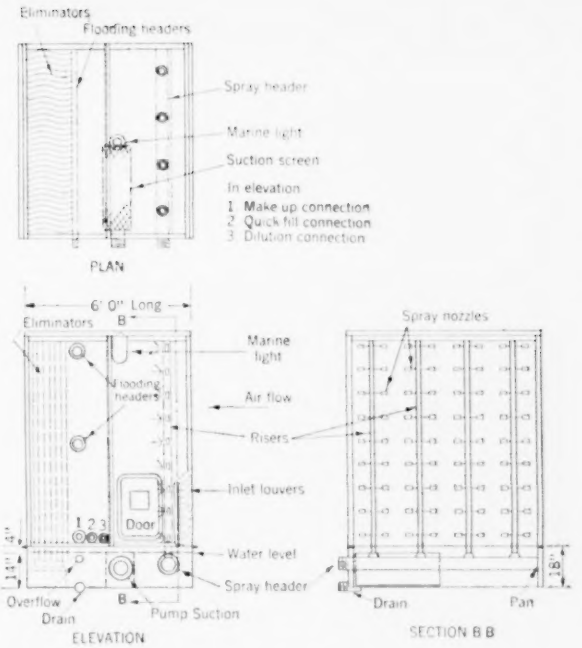

Fig. 14. Typical one bank spray air washer.

Care must be taken at both the inlet and the outlet of the washer that such uniform air flow is obtained. Bad inlet and outlet conditions combined with high velocities will cause trouble from moisture carrying through the eliminators, besides failing to meet the expected thermodynamic performance.

Saturating efficiency figures and performance factor curves were derived from the published information of several manufacturers and other sources. These data are representative of average air washer performance under comparable operating conditions. In the absence of more accurate information, they may be used by the engineer for selecting a washer for air conditioning duty with the expectation that the actual performance will be reasonably close to the predicted conditions. Of course, actual test data under various sets of operating conditions are much to be preferred. However, it is undoubtedly expecting too much that manufacturers will in the near future develop and publish complete performance figures, due to the complexity of operating conditions encountered in practice. The methods of analysis and selection outlined are designed to bridge that gap.

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Low Boiler Water Temperatures Cause Flue Condensation

T. W. REYNOLDS

A discussion of the problems of flue condensation resulting from low water temperatures and improper combustion within hot water boilers.

AN organization sponsored by architects, engineers and the trade called the Radiant Heating Institute of California poses some interesting questions as to the best way to overcome certain troubles which they have experienced with radiant heating. These questions, in reality answers, were given for general enlightment of and to start a healthy discussion of the subject. The main difficulty presented is flue condensation and improper combustion within hot water boilers where the water is passed through a boiler or through some part of the boiler at too low a temperature.

Low water temperatures are due to excessive water volumes through the boiler because of an oversize pump, or lack of water bypassed around the boiler by proper temperature or water control. Low temperatures can also be created in some part of a boiler because of (1) short circuits and water stratified or stagnated and (2) hot spots elsewhere in the boiler brought about by improper cleaning or air relief of the boiler.

In commenting upon the points raised, the subject will be extended to include low boiler water temperatures which sometimes occur in boilers used with snow melting systems and swimming pools. Although Southern California is not interested in snow melting, local trade has encountered flue condensation in hot water boilers for swimming pools. The substance of the letter follows:

"Boiler water temperatures in Southern California do not need to be high enough for service hot water supply, because such supply is commonly obtained from separate gas-fired hot water heaters. As a consequence, many of our heating boilers are fired and controlled at the lower water temperature used with radiant heat coils. This results in sweating with gas-fired boilers and an almost impossible combustion condition with oil-fired boilers. Hence, our committee feel that such boilers should be operated with a minimum water control temperature of 130F. This could be accomplished by installing a three-way thermostatic control valve to bypass some of the water around the boiler and to keep the temperature rise through the boiler to not less than 20F. Quite often the temperature is less than this because the circulating pump is too liberally sized.

"Another condition which we encounter is where the same size of relief valve is used for all boiler sizes. For example, a boiler may have a 2-inch relief valve which, when popping, takes all the water out of the boiler and causes a broken or burnt out boiler. Furthermore, many a heating system is not boiled or flushed out upon completion. Therefore oil, grease and dirt are circulated to load the boiler, pump, and controls with muck and to develop dangerous hot spots within the boiler. Acid is thereby formed which, along with the oversize pump entraining oxygen, sets up a highly corrosive condition that attacks the entire system.

"Boiler piping is often improperly arranged for effective air venting of the system; expansion tanks are usually too small and are often waterlogged. We would therefore appreciate a rough sketch of the connections around the boiler and tank. We would also appreciate comments on the proper water temperature, temperature rise, use of a three-way control valve, size of pump and relief valve, and the method recommended for air venting and sizing in radiant heating systems."

Hot Spots In the Boiler

I also received a second letter upon the same subject from another source in California. The letter that was received follows:

"Some contractors and engineers will size pumping equipment so far beyond job requirements that a condition is produced on a radiant heating installation which is similar to a swimming pool installation where its pump is sized on the basis of filter size. At times the pump capacity greatly exceeds the boiler capacity. As a result, we encounter a condition that you yourself wrote about in one of your articles, namely, the stratification of boiler water, hot spots and steam bubbles. All this is eliminated by the use of a proper by-pass or thermostatic control."

Apparently the correspondent refers to the articles in HEATING AND VENTILATING, in November, 1950, and October and November, 1951 entitled Errors Often Made in Forced Hot Water Heating Systems, Part I, and Measure to Avoid Troubles in Domestic Hot Water Systems, Parts I and 2." The pertinent remarks referred to will bear repetition, although they were made with other things in mind. They are as follows:

"All hot water boilers have hot spots due to unequal hot transfer. These in turn are caused by localized variations in gas and water flow, flue gas temperature, combustion of fire at different points, and short circulating of water directly from inlet to outlet where connections are improperly arranged so as to provide a short or direct path. Hot spots generate steam bubbles which may rise too rapidly for the inadequate circulation to remove to the expansion tank where they can cool and collapse. This will produce a vapor lock within the boiler top and at the pump, or in the down pipe.

Steam lock is more apt to occur in over-fired boilers, or whenever fires are uncontrolled, such as with hand-fired boilers, or in stoker-fired systems where residual heat overrides as the stoker stops. Gas-fired boilers are not apt to give trouble, due to only slight residual heat remaining after a burner is out. Steam lock can be elimi-

nated by venting steam from the boiler top to the expansion tank by way of a circulating or so-called safety loop.

Commenting upon remarks as made in these articles, I would say that they could apply to the main subject under discussion where boiler water temperatures are high and particularly so with short circuits in boilers of high water content. Hot spots would also become pronounced in relation to other spots within the boiler where heat transfer was poor due to adhering scale or there was inadequate circulation due to muck.

Commenting further, a boiler of small water content tends to flash steam, but being small, it should eliminate short circuits; a boiler with all water passing through it (no bypass) should have low water temperatures and therefore a reduction in the number of hot spots. A circulator tends (1) to produce short circuits and (2) to increase the rate of heat transfer. It may upset natural boiler circulation, but if its flow favors no particular part of the boiler, no harm can result.

Conditions With Swimming Pool Boilers

Generally, the water passed through swimming pool boilers is not at a high temperature, due more particularly to the large volume of water passed. Water temperature conditions are not much different than they are with some of the radiant heat coil jobs under ordinary conditions. However, to avoid trouble due to real low water temperatures, much of the water is now commonly bypassed around swimming pool boilers. This improves operating conditions in large boilers, such as these, since the boiler is allowed to function more as a boiler by natural circulation and not be stratified in some part due to too much water flow elsewhere within as caused by a pump of too high a head.

In some cases with swimming pool boilers without a bypass, the combustion condition was so bad that on many of the boilers, the insulated jacket would become saturated. A cast iron gas burner with a drilled port would become practically plugged by the condensation of combustion gas.

Low Boiler Water Temperatures for Snow Melting

Since Southern California is not troubled with temperatures much below freezing at any time, most installations would only have an outdoor design temperature of 20 to 35F. However, it should be of interest and helpful to consider the condensation of flue gases as sometimes encountered under the more severe conditions which exist in some snow melting applications. In such cases, there may be a rapid circulation of extremely cold water through the boiler, especially when starting up. This difficulty was usually overcome by bypassing some of the cold return water around the boiler and controls during the warming-up period.

A low temperature condition can also follow where it is desired to reduce boiler size by eliminating the pick-up load when snow starts to fall. In such a case, water is circulated at a very low temperature when snow is anticipated. The temperature is raised to the final point desired only when snow falls. For example, a medium temperature of 60 to 80F is sometimes used before snow falls. It temporarily reduces the more usual melting load to about half. Such a condition most certainly requires that most of the water be bypassed. Even then, the water that does flow through he boiler will still be at a rather low temperature.

As a general rule, the average water temperature in snow melting systems is 160F. The temperature drop is usually 20F, but sometimes it varies from 10F to 30F to suit the size of melting area, and a reasonable pumping head. A high temperature drop may cause uneven melting.

Water Temperatures in Radiant Heating Systems

One of the advantages of hot water heating, whether with panels or other devices, has been the economy and comfort obtained by circulating water at low temperatures when outdoor air temperatures are high. This is particularly true where the climate is mild as in Southern California. Under some weather conditions, this might require a rather small percentage of water to be circulated through the boiler. However, this percentage will increase if the boiler water temperature is kept down to say 140F instead of 180F. The temperature may even be reduced to 120F without appreciable condensation of flue gas. For example, service hot water supply is usually at a temperature of from 120F to 140F, depending upon the size of residence or length of piping run.

Generally a system designed for the highest practical initial and mean water temperatures has lowest installation costs. Of course this is due to the greater thermal output per pound of water circulated. For example, a pump with capacity of 40 gpm may be required at a temperature drop of 10F; double this drop and the capacity required becomes only 20 gpm. The required pump horsepower would remain the same, but the sizes of mains could be decreased. This is based on no change in pressure drop. If, however, a higher pressure drop were used, pipe sizes could be further reduced, in which event the motive power would have to be materially increased.

As a rule any increase in operating power cost for a larger motor will be offset, or nearly so, by the saving in interest on investment in installation cost due to smaller mains. Some of the energy used to overcome friction makes a small increase in water temperatures. Of course, the economics of all this is affected by the length of the heating season, the cost of power and the installation size.

One other factor of cost is that minimum usable water temperatures may be desirable with closer tube spacing since this results in greater uniformity of surface temperatures of panels and therefore provides economy in fuel. Incidentally, the usual total temperature drop is 15F to 20F while the total pump head is generally limited to 30 ft to prevent noise caused by high water velocity. Of course, all these factors enumerated are not necessarily prohibitive to the use of high boiler water temperatures with bypass control. However, they are factors which should be weighed to obtain a constant boiler water temperature of 180F in radiant heating systems.

Air Venting

As a general rule, even small air pockets will retard circulation and create an unbalanced system. A pump

with high lift may be helpful to move the air along, but sometimes even a high lift pump will not overcome some air pockets. Such pockets are often formed by poor grading, eventual sagging due to inadequate supports at infrequent intervals, and by pipes unevenly installed and made worse by workmen treading on them. In this way, a good method of air venting can be materially offset. Connecting city water supply to the coils as a temporary measure to force out the initial air in pockets may obtain enough circulation to pass the initial test, but one feels sorry for the purchaser.

Air traps and their test cocks should be located for easy operation, repair, and at points where they cannot freeze up since water does not circulate within the valves when not venting. Warm air can circulate around the air trap if located back of a grille opening to a heated space. Incidentally, an increase in size of vertical flow and return mains lowers the water velocity and thereby helps to vent air.

Meanwhile, it is desirable to rid the system of air as soon as possible after the water leaves the boiler. There may be some good air vents at other places for use with initial fill, but why carry the air around and possibly hinder circulation up to these points. It is most desirable that an expansion tank be installed with special fittings at the boiler and tank in the pipe connecting them so that air can be vented immediately from the top of the boiler and directed up to the tank. Such fittings were described in detail in one of the articles previously referred to (H&V Nov., 1950).

The expansion tank should be properly sized although usually it is not. In this connection, Bell & Gossett Company are conducting tests to fix more definitely the proper size of expansion tanks for radiant heat and high temperature heating systems. When an expansion tank loses its air cushion, it loses its properties of expansion. As a consequence, the relief valve will operate frequently to waste water with its contained heat. New make-up water is then required and this must be freed of air.

Size and Number of Relief Valves Required

In many installations a single relief valve may be of proper size for adequate relief, yet become a source of considerable damage due to over-relief from over-size. Quite often, on a single boiler there should be two or three relief valves installed in steps as to pressure and relieving capacity, particularly so with boilers of small water content.

A roof installation of a boiler is quite apt to be gas-fired. One such installation with a 2,000,000 Btu input and only 100-gallon water capacity, had a single 2-inch relief valve. When the expansion tank became water-logged, the system built up a pressure sufficient to open the relief valve with a bang, thus suddenly relieving nearly all the boiler water over the boiler room floor. The velocity of escaping water was sufficient to hold the float of the low water cut off in the closed position. This boiler installation cost $300 to replace. In an assembly of three step type relief valves, the relief valve of lowest setting (30 lb) would have relieved the immediate pressure in this installation.

New Non-Fuel Use for Anthracite

Production will start soon on a new non-fuel use for anthracite. Anthracite Equipment Corp., a wholly owned subsidiary of Anthracite Institute will produce AnthraAid a talcum-like substance made from anthracite and designed for use by industries engaged in the processing of chemicals, petroleum, food, beer and pharmaceutical products. By adding this material, the removal of suspended solids from liquids will be made easier.

This material has already been used by many of the largest chemical and food companies in plant-scale tests and it is said that the results have been highly favorable. The product has been evolved after several years of research. Equipment is now being installed in a building leased from Jeddo-Highland Coal Company in Jeddo, Pa. Production is expected to start about July 1.

For some time, the most commonly used filter aid has been diatomaceous earth which is found in large deposits in California, Oregon, Nevada and Washington. Production of this diatamaceous earth has doubled since 1941 and has quadrupled since 1932, indicating a rapidly increasing potential market for the filter aid material.

Advantages over some of the other commercial filter aids are its geographical location and the fact that it consists mainly of carbon. It is located in eastern Pennsylvania close to the heart of this country's large industrial area so that in many cases there is a decided reduction in shipping costs when compared to the material that must be brought in from the west.

For some years this company has been producing and marketing Anthrafilt, a filter medium made of anthracite. This material is now being used in filter beds by municipal and industrial water filtration plants. Extended research at the institute laboratory in the use of anthracite for filtering purposes has resulted in the development of the new filtering aid.

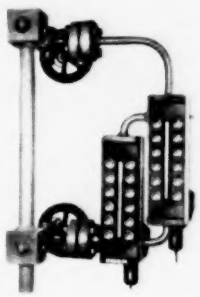
In line with the policy of Anthracite Institute's Board of Directors, new non-fuel products will be produced and marketed by the Anthracite Equipment Corporation. Until the tonnages of this material produced are appreciable, the net income from such corporation enterprises will be used to support further anthracite research along these lines.

NEWS OF EQUIPMENT AND MATERIALS

Use the prepaid postcard opposite page 123 for securing additional information on items described in this department.

Water Gage Assembly

Greater dependability, longer gage life and more accurate water level readings in high pressure service are some of the advantages claimed for a new separated-design water gage assembly developed by the Yarnall-Waring Co., Philadelphia, Pa. The gage glass inserts are of the Yarway pressure-sealed floating assembly type. The gage valves are Yarway Welbonds.



On gages for wide range of visibility, greater flexibility is gained by using two independent inserts and by interconnecting expansion loops. On gages for medium ranges, using one insert, a single expansion loop is used. The lower flanged connection and the upper flanged loop connection result in the elimination of stuffing boxes. The short lower flanged connection eliminates the cold water leg, resulting in greater accuracy in level reading.

The tie-bar-type water column linking the gage valves provides circulation to keep gage nearer drum temperature.

More Information? Circle Item 1 on postcard, page 123

High, Low-Boy Gas Furnaces

Two new gas-fired furnaces, highboy and lowboy, complete winter air conditioning units for heating with natural, manufactured, mixed, or LP gases, or with any of the LP-Air mixtures, for houses and other small buildings, are announced by Iron Fireman Mfg. Co., Cleveland, Ohio.

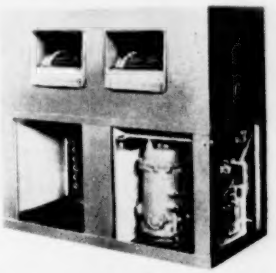
The burner is developed by the firm and uses a radiant multiple disc heat distributor to assure high combustion efficiency and fast, uniform heat transfer to primary heating surfaces. Resilient mounted blowers with permanently lubricated, sealed ball bearings provide quiet operation with low power consumption.

These gas furnaces are identical, except for burners, with the lowboy and highboy oil-fired furnaces introduced last year by the company. Burners, consequently, are readily interchangeable in the event a change of fuel seems advisable. Both furnaces are completely assembled and wired at the factory, ready to be plugged in on the job.

More Information? Circle Item 2 on postcard, page 123

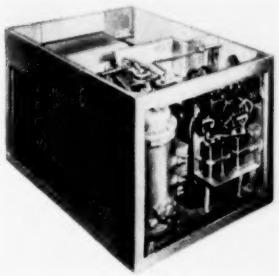
Air Cooled Residential Coolers

A line of central-type air-cooled residential air conditioners are introduced by Airtemp Division, Chrysler Corp., Dayton, Ohio. The line includes two different types. Neither requires water or water piping.



The two types of conditioners are the self-contained packaged unit for interior installations (top view) and the custom series in which the refrigerating unit is located outside the home (lower view) and the cooling coil is mounted in the main furnace air discharge duct. The two component parts are connected by copper refrigerant tubing.

Both air-conditioners employ outside air to cool the refrigerant that has removed heat from the home. In the case of the packaged unit, the outside air is brought into the attic and later discharged. Both are produced in two and three-horsepower sizes, to cool average homes containing up to eight rooms throughout most of the country.

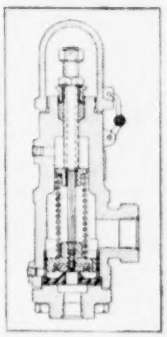


Noiseless operation and a new degree of compactness have been attained with a new four-cylinder, high-speed radial compressor. Life expectancy of the new compressor is said to be considerably longer than the average eight-to-ten year life of a reasonably-cared-for automobile engine.

More Information? Circle Item 3 on postcard, page 123

Refrigerant Safety Valves

A line of refrigerant safety valves, Type AF, has been introduced by Frick Co., Waynesboro, Pa. They have been tested for capacity and approved for use with various refrigerants by the National Board of Boiler and Pressure Vessel Inspectors.



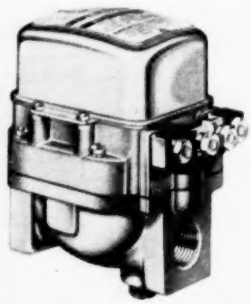
Said to handle between two and three times as much gas as the previous type of the same pipe size, the valves have seat and moving parts of stainless steel so that there is nothing to rust shut and the valve closes tightly after it opens. If scale catches under the button, the valve can be reseated with a light tap on the plunger stem.

Double sets of safety valves are recommended for use on every large refrigerating system. Dual-outlet valves make it possible to remove one safety valve at a time if desired. They are furnished in sizes from ½ to 2 inches.

More Information? Circle Item 4 on postcard, page 123

Pilot Uses No Primary Air

Featuring a new Powerpile with a blue flame pilot that uses no primary air and eliminates the problem of clogging, a new self-powered control system for gas burners, is announced by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.



The new pilot is no larger than a matchbook and is described by the company as the first completely lint-free pilot in the gas heating industry. A very small amount of gas is introduced through minute holes spaced relatively far apart. This permits a sufficient amount of secondary air to be mixed with the gas at the point of introduction, resulting in complete combustion and a soft, blue flame. No air from the atmosphere is brought into the gas stream before it is burned.

Combustion is quiet under a wide range of gas pressures. There is no lifting, sputtering, or candling, even at pressures as high as 12 inches water column. Electric power ranges from 500 to 800 mv, depending on the temperature of the surrounding air, the type and pressure of the gas being used and the prevailing secondary air flow. With this increased power, more of it can be diverted into the thermostat in the form of heat anticipation. The new design provides all the safety features of a single port pilot. The same flame that heats the thermopile also ignites the main burner.

Installation and servicing also are simplified. The inlet connection is flexible and may be swiveled through 360 degrees, or may be formed as required to route the pilot gas line in whatever direction is desired. There is one orifice for all street gases, including natural, mixed and manufactured. For LP gas, a readily interchangeable orifice is available. It is a simple matter to replace a thermopile element in the field without removing the pilot burner assembly.

More Information? Circle Item 5 on postcard, page 123

Trenching Machine for Tractors

The Blackhawk Trench Hog, a light weight trenching unit for Ford and Ferguson tractors, is available from Arps Corp., New Holstein, Wis. It can be equipped with booms 3½, 5½ or 7 feet in length for digging trenches of such depths.

The machine is offered with standard or slicer cutters for ordinary and sticky soils in widths of 6 through 20 inches, or with super-service or disc cutters for extremely hard and rocky soils and frozen ground, in widths of 7 through 18 inches.

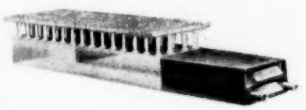
Accessories include a one side dirt delivery attachment, a high speed sprocket for digging narrow shallow trenches up to 800 ft an hour, a heavy duty power sprocket for deep and wide trenches, a bulldozer blade for quick backfilling, and crumber attachments for clean, smooth trench bottoms.

The machine is designed for digging foundations, trenches for water and sewer lines, gas and electric installations, drainage systems, and road construction.

More Information? Circle Item 6 on postcard, page 123

Large Gas Burners Added

A new series of commercial gas burners, in stock sizes ranging from 450,000 Btu per hour input upward to 11,520,000 Btu or more, is announced by Petro, Cleveland, Ohio, to supplement gas-fired equipment previously announced.



This multiple section upshot burner is easily installed through the ash pit door. The numerous possible combination of burner heads make it possible to apply the burner for the most effective use of the fire box area. Individual Venturi mixing tubes for each burner head assure uniform mixture to all parts of the burning area. Primary air entrainment is high, and adjustment is provided for various types of fuel gas.

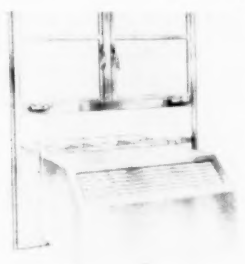
No refractory combustion chamber liner is used. All heat is transferred immediately to the furnace or boiler, and response to demand for heat is instantaneous. A metal plate set flush with the burner heads prevents heat from reaching the boiler base and reduces boiler room temperature by eliminating escape of heat through the floor.

When recommended controls are used, the burner is step-acting and is modulated so that various burner sections come on in sequence instead of all at once. Burner head sections may be controlled either by independent manual or by automatic valves.

More Information? Circle Item 7 on postcard, page 123

Casement Window Fits Room Units

A new type of steel casement window especially adapted for room air conditioner units is introduced by The Steelcraft Mfg. Co., Rossmoyne, Ohio. The window will accommodate any standard room air conditioner unit.



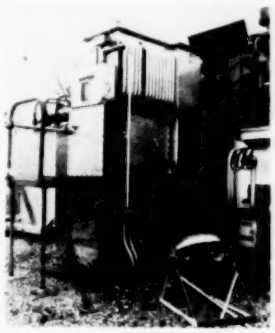
The window employs an adjustable member to enable the installation of practically any popular make of room air conditioner. The windows are manufactured in four standard types and sizes.

The windows were developed in conjunction with some twenty unit manufacturers, and are available at only a slightly higher cost than standard casements.

More Information? Circle Item 8 on postcard, page 123

Weather-Proof Industrial Fans

A new line of weather-proof fans for transformer cooling and other severe outdoor applications where the fan must operated unattended is introduced by Propellair Div., Robbins & Myers, Inc., Springfield, Ohio. The fans are available with blade sizes of 16, 20, 24 and 30 inch, with certified air delivery ratings from 2820 to 6710 cfm. All sizes are equipped with the company's airfoil cross-section aluminum propeller, and may be obtained either with or without cradle type mounting stand.



The fans are completely protected against the elements. The welded steel mounting ring assembly is phosphatized before painting to assure corrosion resistance and good paint adherence. The weatherized motor is equipped with rubber gaskets that seal the removable cast iron end heads. The sealed, pre-lubricated ball bearings, which eliminate frequent re-lubrication, are protected by a grease-filled cavity in the hub that provides a moisture seal around the shaft.

More Information? Circle Item 9 on postcard, page 123

Right Angle, Worm Gear Motor

Its right angle Syncrogear motor, type GW, using a sturdy pyramidal base design, is available in a wide variety of assembly and mounting positions from U. S. Electrical Motors, Inc., Los Angeles, Calif.

Ratings which are now available include: 3 Phase, ½ to 1½ hp in the Uniclosed design and ⅓ to 1 hp in the Singlenclosed design; and single Phase, ½ and ¾ hp. Other ratings of ½ and ⅓ hp will be available in June, while larger ratings up to 3 hp are being developed.

All usual modifications are available and double end slow speed shaft extensions can be furnished. Prices and dimensions of this motor with its additional mounting applications are shown in the Form F-1650 Catalog, along with features and applications. Cutaway color diagrams show construction of motor and design features.

More Information? Circle Item 10 on postcard, page 123

Vacuum Breaker Pressure Tank

A vacuum breaker has been added to its line of pressure tanks for hot water heating systems by H. A. Thrush & Co., Peru, Ind.

A pressure tank may occasionally have to be drained, a job generally unprofitable because of time consumed. A vacuum breaker admits air quickly, speeds draining and saves time. It is being furnished at no extra cost.

Illustration shows pressure tank with side cut away showing how the vacuum breaker is installed. Installation is made at the factory.

The tanks are available in 5 sizes with capacities ranging from 250 to 3000 sq ft of radiation.

More Information? Circle Item 11 on postcard, page 123

Enclosures for Flame Control

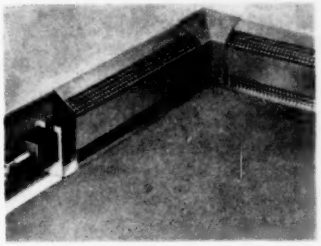
Flush type enclosures for its 26 series flame failure safeguard controls are available from Combustion Control Corp., Boston, Mass. These units are included in the Fireye Flame Safeguard systems FP-2 and FP-4 for both automatic and manually fired burners of all types.

The FP-4 system is used for the manual or semi-automatic fired gas-oil or coal burners and the FP-2 system is used for the full automatic fired burners and they are both supulied with dust tight flush mounted control housings finished in black crinkle. These controls can be readily mounted in the combustion control power panel with all the control wiring concealed in the rear of the panel. Bulletins CP 519 and CP 520 are available.

More Information? Circle Item 12 on postcard, page 123

Floor Level Convector Unit

New features have been incorporated into a baseboard convector introduced by Rempe Co., Chicago, Ill. The cover, when installed, rests on the floor and is said to solve wall-to-wall carpeting problems. The carpet can be laid up to the convector cover instead of under it. When wall-to-wall carpeting is not used a quarter round covers the joint between the convector cover and the floor.



The cover has air stream outlets in front and on the slanted portion of the cover to direct the warm air away from the wall, outward and then upward, thus keeping walls clean. Slanted cover also discourages tendency to stand on it or to be used as a shelf. Cover is 3 inches wide by 8 inches high.

The new convector can be used on either old or new construction, and is practical for one and two pipe hot water systems, two pipe vapor, or steam.

Simple installation is a feature. A back plate rests on the floor and is secured to the studs. Element hangers snap on to the back plate. Element, after assembly, is placed in the hangers, eliminating field alignment problems. Corner sections and end plates are provided. Element is 1 inch copper tube, 3 × 3 inch fins, furnished in 10 ft lengths.

More Information? Circle Item 13 on postcard, page 123

Simple Damper Regulator

Regulation of air flow in heating and air conditioning systems is simplified by the Wa-Trol regulator, manufactured by Wa-Trol Co., Houston, Tex.

By eliminating the use of wrenches, the flow of air can be quickly adjusted in about half the time formerly required. An indicator on the knob shows the position of the damper in the duct. Adjustment is made by pressing the knob and turning. When it is released, the spring-loaded knob locks in position.

The regulator is made of styrene plastic in a variety of colors.

More Information? Circle Item 14 on postcard, page 123

Stainless Strip Available

Stainless steel strip, precision-rolled to close tolerances, and to thin gage and foil, for use in the manufacture of refrigerating, air conditioning, and heating equipment, is readily available from the Industrial Division, American Silver Company, Flushing, N. Y. Stainless steels, in the 300 and 400 series, are custom rolled by this company in strips up to 8 inches wide, and down to .0005 inch thin, to tolerances as close as one ten-thousandth. The strip is available in any quantity from one pound to thousands of pounds.

More Information? Circle Item 15 on postcard, page 123

Commercial Air Conditioner

A summer air conditioner for commercial establishments is a packaged unit placed on the market by American Radiator & Standard Sanitary Corp., Pittsburgh, Pa. The new product, built around a hermetically sealed refrigerant circuit, is manufactured in two models; CCA-2 and CCA-3, of 2 and 3 horsepower, respectively.

Through summer cooling the new Mayfair model is designed to increase the comfort and patronage of banks, professional offices, retail stores and almost every type of business establishment serving the public. In addition to controlling the temperature, the Mayfair also controls the humidity, ventilation, cleanliness and circulation of the air during summer weather.

Cooling capacity for the 2 horsepower model is 24,000 Btu per hour, for the 3 horsepower model, 36,000 Btu per hour. If the cooling load exceeds these ratings, then multiple units can be installed.

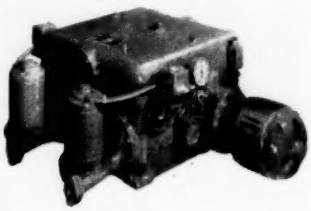
Winter heating can be provided by the addition of a heating coil. Extremely compact, either model can fit into the same small 22 x 25 inch floor space. Cabinet is constructed of heavy gage steel, bonderized and finished in a baked-on enamel.

The hermetically-sealed refrigeration circuit in each unit is internally spring-mounted for quiet operation, less vibration, and longer life of the unit. Controls include an adjustable thermostat and a three-way switch so the fan may be operated alone when cooling is not needed. A humid weather control permits removal of excessive moisture from the air on hot muggy days without the unpleasant effects of overcooling. Conditioned air is supplied by a centrifugal type fan.

More Information? Circle Item 16 on postcard, page 123

Vacuum Pump Has Low Return

An extremely low return line connection which greatly reduces installation cost, is a desirable characteristic of the new CSM vacuum heating pump announced by Nash Engineering Co., South Norwalk, Conn. In the new pump, air pumping and water pumping units are separate, each with its own motor control. Each pump operates only when needed, reducing operating cost.



Since the capacity of the individual pumping units may be varied at will, it is no longer necessary for the engineer to accept a heating pump with air and water capacities based inflexibly upon square feet of equivalent direct radiation. He can now provide proper air and water capacities based on his judgment and experience.

Because of the flexibilty of the new design, capacity may be increased to accomodate additional radiation without changing basic pump installation.

More Information? Circle Item 17 on postcard, page 123

Cap for Chimneys, Ventilators

The Draft King, a cap for chimneys, flues, and ventilators, with no moving parts, and constructed of galvanized steel or aluminum, is announced by A. R. Wood Mfg. Co., Luverne, Minn.

Due to its design, the upper and lower draft rings are kept warm by flue gases, keeping the cap from freezing shut with ice and snow. The cap will not soot shut, due to its open construction, which allows free passage of wind from all directions.

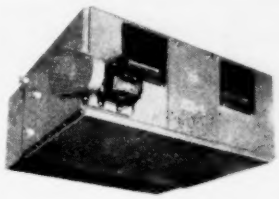
The cap creates even stack temperature in chimney at all times, eliminates pilot blowouts, low and high fire fluctuations, and acts as a spark arrester.

It can be used on furnaces, space heaters, hot water heaters, stock tank heaters, trailer houses, fish houses, cottages, and for ventilating systems.

More Information? Circle Item 18 on postcard, page 123

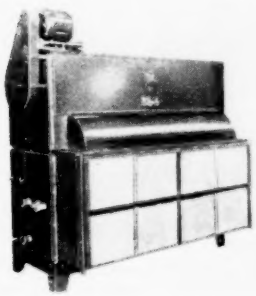
Unit Air Conditioners

The Seasonmasters, a line of horizontal and vertical central station air conditioning units, is available from McQuay, Inc., Minneapolis, Minn. The horizontal units (upper view) are available with water coil, steam coil, face and by-pass, and flat filter section. The vertical units (lower view) are available with direct expansion coil, steam coil, face and by-pass, and flat filter section.



Framework is of heavy gage galvanized steel channels with removable panels and a ½-inch thick rigid thermal acoustic insulation. Fans are of the forward curved blade type and the bearings are bronze, oil lubricated.

All coils are of ripple fin construction with ⅝ inch O.D. seamless copper tubes expanded into smooth collars of aluminum fins. Joints are copper brazed.



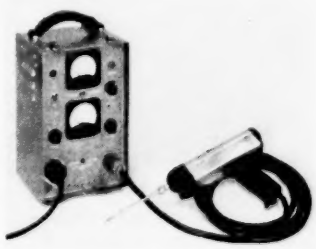
Standard belt 1725 rpm motors are furnished unless otherwise specified. Flat type filter section is available for all units. V-type for multiple fan units. Two-inch thick throwaway or cleanable filters are available. Filtered air by-pass is provided by the face and by-pass damper sections and by-pass duct. Spray or steam pan humidifiers are optional. Each model is available in a wide range of sizes. Catalog 505 is available.

More Information? Circle Item 19 on postcard, page 123

Loudspeaker Leak Detector

Its halogen-sensitive leak detector has been redesigned to permit easier detection of leaks in closed systems, according to General Electric Co., Schenectady, N. Y.

The portable instrument, introduced five years ago, can detect a leak so small that only 1/100 ounce of gas will pass through the opening in a year. It has gained wide acceptance in testing for leaks in refrigerator and air conditioning systems, tanks, boilers, piping, and other products that must be leak proof and into which a halogen gas can be introduced as a tracer.



In the redesigned equipment Type H-1, a loudspeaker has been built into the control unit for audible indication of leaks. The new device also features an automatic balancing circuit to compensate for changes in background air contamination. Incorporated in the control unit is a new light-weight, internal voltage stabilizer. The former model required an external voltage stabilizer.

The Type H-1 detector retains the features made popular in the former model, such as the earphone plug and the instrument indication of leaks. Now, however, leak indication can be simultaneously indicated by means of the dial, earphone attachment, or through the built-in loudspeaker.

More Information? Circle Item 20 on postcard, page 123

Fibre Pipe Tapering Tool

A fibre pipe tapering tool which makes 100% salvaging of shorts or field-cut ends simple and automatic is announced by Line Material Co., Milwaukee, Wis. It weighs 8¾ lb, is compact, and can easily be carried to job sites.

The tapering tool is composed of an internal expanding mandrel which firmly grips the entire inside circumference of the pipe, giving the tool a firm bearing surface; a threaded feed mechanism which feeds the tool bits forward automatically as the handle is rotated; and two high-speed steel tool bits which are cut to the exact angles necessary to hold factory tolerances.

More Information? Circle Item 21 on postcard, page 123

Weatherproof Ribbon Seal

A fabric-reinforced black synthetic rubber sealer in ribbon form that can be used as an effective weatherproof, water-tight seal is announced by Adhesives and Coatings Div., Minnesota Mining and Mfg. Co., Detroit 2, Mich.

Designated as EC-1202, the sealer is easily applied by simply laying or pressing the ribbon on one surface before riveting, screwing or bolting the second surface to the first. Adhesion properties are such that the ribbon will stay in place on vertical or overhead surfaces during assembly operations. It can be stripped off and reapplied, if necessary.

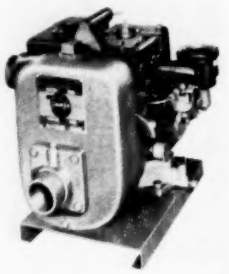
Because of the cloth reinforcement, the sealer ribbon does not stretch or sag during application. It thus eliminates variations in thickness and poorly sealed joints often incurred when using conventional sealers. Ribbon design also avoids waste of sealing material and simplifies application. The product is non-shrinking, contains no solvent and is not a fire hazard. It is not resistant to oil, gasolines, and other solvents.

It is available as packaged rolls in 1/32 and 1/16 inch thicknesses, in seven widths ranging from ¼ to 2 inches and in lengths of 100 and 200 feet.

More Information? Circle Item 22 on postcard, page 123

Line of Contractors' Pumps

A line of all-purpose, heavy duty contractors' pumps has been developed by Lancaster Pump and Mfg. Co., Inc., Lancaster, Pa. These gasoline engine equipped pumps are available in many models and sizes.

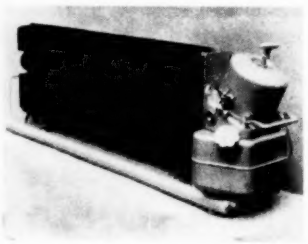


Model 675, a 1½ inch pump has a 1.5 hp engine, is capable of heads to 90 feet, and has a capacity of 6600 gph. Model 676, a 2 inch pump, has a 1.9 hp engine for discharge heads to 100 feet and a maximum capacity of 8300 gph. Features of this new line are self-priming performance, rugged construction and solid one piece base, large priming plug, and reliable mechanical seal.

More Information? Circle Item 23 on postcard, page 123

Gasoline Heating Unit

The Swingburner, a gasoline fueled two-stage heater with an adjustable output up to 100,000 Btu per hr, is introduced by Devenco, Inc., New York, N. Y. The unit produces a fast intense heat and is a variation of equipment developed in Germany during the war for supplying intense pre-starting heat for internal combustion engines.

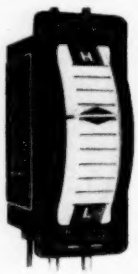


The device is designed to fit into any conventional firebox and has many applications, particularly in construction operations carried on in sub-freezing temperatures.

More Information? Circle Item 24 on postcard, page 123

Improved Level Indicator

Easier readings of liquid levels are made possible by a new type face and cover plate on Yarway remote liquid level indicators, according to Yarnall-Waring Co., Philadelphia, Pa. The raised, transparent face permits the indicator arm to be extended under the cover to a position where it can be viewed from the side as well as the front. This improved visibility makes it possible to check boiler water levels or other liquid levels from most any location in the control room or wherever the Yarway Indicator may be installed.

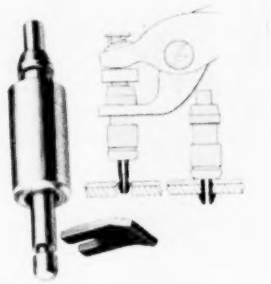


The indicating mechanism is operated by the boiler water itself, assuring instantaneous, accurate readings. Indicating mechanism is never under pressure. There are no stuffing boxes.

More Information? Circle Item 25 on postcard, page 123

Sheet Metal Fasteners

Metal or hard surface parts containing drilled or punched holes can now be temporarily held together in alignment and under pressure when combined materials are as much as four inches thick by metal fasteners, made in a variety of sizes, by Wedgelock Co., North Hollywood, Calif.



These tools hold materials such as templates, sheet metal, and small fittings in place during drilling, riveting, fabrication and assembly. They replace bolts and nuts for temporary fastening. They are applied from one side of the work and can be used over and over again.

Fasteners of both spring actuated and hand operated wing nut type are available in a range of sizes and capacities.

More Information? Circle Item 26 on postcard, page 123

Acid-Proof Plastic Valves

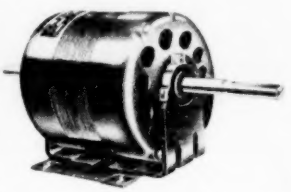
A line of corrosion resistant plastic globe and Y valves is introduced by Vanton Pump Corp., New York, N. Y. Constructed entirely of polyethylene, except for the sealing diaphragm on the disc which is composed of a polyethylene-polyisobutylene mixture to insure maximum resilience and drop tightness, these valves will withstand the corrosive action of most acids, including sulphuric, hydrochloric, nitric and hydrofluoric, as well as a variety of caustic solutions.

Relatively light in weight, but high in strength, the valves are recommended for working pressures up to 50 psi and temperatures to 150F. At this time, ½, 1, 1½ and 2 inch sizes are available, with larger sizes soon to be announced.

More Information? Circle Item 27 on postcard, page 123

Motors for Unit Equipment

Latest addition to the fractional horsepower motor line of Electric Motor Corp., Div. of Howard Industries, Inc., Racine, Wis. is the Model 5000 motor, specifically designed for fan duty in air conditioners, window fans and other similar applications.



It is a 6-pole shaded pole motor with drawn steel housing, self-aligning bearings and is offered as a two-speed or single speed motor, available with or without rubber mounts and resilient base and overload protection.

Speeds of 1950 rpm with lower second speed of approximately 300 rpm are standard. Ratings offered are 1/15, 1/12, 1/10 and ⅛ hp.

More Information? Circle Item 28 on postcard, page 123

Cooling Tower for House Jobs

A small cooling tower for residential, commercial and industrial air conditioning systems is the newest addition to the line of Marlo Coil Co., St. Louis, Mo. Known as the Thrifti-Tower, it is designed to save up to 95% of normal water demand. It anges in capacity from 2 to 16 tons.

The unit, quiet, compact and light in weight, is adaptable to indoor or outdoor installation with the lowest possible erection costs. Unisection design enables simple and rapid disassembly if necessary. A feature of the tower is the Lektro-Tektor protection against electroyltic corrosion of the sump tank.

A bulletin is available.

More Information? Circle Item 29 on postcard, page 123

Enclosed Motor Line

As a companion line to its fan-cooled motors, Wagner Electric Corp., St. Louis, Mo., has developed a cast iron frame totally enclosed non-ventilated motor in frame sizes 66, 203 and 204. These motors are available in the standard type EP, and also as explosion-proof type JP, with Underwriters' Laboratories approval for Class 1 Group D hazardous locations.

This addition makes available to industrial users a complete range of cast iron frame enclosed motors, from ½ through 250 hp. Type EP and type JP motors are recommended for use in chemical plants, paper mills, oil fields, petroleum refineries, mines, steel mills and similar locations where extra protection against corrosion is a required feature.

More Information? Circle Item 30 on postcard, page 123

Hermetic Freon Pump

A hermetically sealed pump which has been designed to handle liquid Freon refrigerants, is introduced by Heatron, Inc., York, Pa. It is applicable to many refrigeration recirculating systems to increase efficiency and simplify controls. It is particularly effective on low temperature and ultra-low temperature Freon refrigeration systems.

Single and multiple evaporators may be handled under varying head and flow conditions. An oil return feature automatically holds oil concentration in evaporators to a minimum.

Eight sizes are available ranging from 4 to 40 gpm against heads up to 50 pounds per square inch with motors from ¾ to 3 hp.

A four-page bulletin with line application drawings, dimensions and additional data is available.

More Information? Circle Item 31 on postcard, page 123

Hot Water Relief Valves

A line of ¾, 1 and 1½ inch hot water supply and heating boiler valves is announced by Kunkle Valve Co., Ft. Wayne, Ind. Fig. 137, a safety valve for hot water boilers, is rated at 598,000 to 9,375,000 Btu per hour at set pressures from 30 to 160 psig.

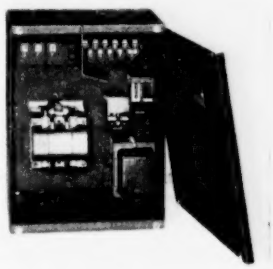
Figs. 41 and 42, domestic hot water relief valves, are rated for capacities up to 700,000 Btu per hour at 125 lb and are furnished with or less fuse plug or test lever.

Distribution will be through established wholesalers. Technical Bulletin 137-41 is available.

More Information? Circle Item 32 on postcard, page 123

Heating, Cooling Control Package

A complete package of residential air conditioning controls has been developed by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. The complete package provides a single, pre-assembled system that is applicable either to a combination heating-cooling unit or an add-on cooling unit for an existing heating plant. It can be used on heating and either single or two-stage cooling units with 2, 3 or 5 tons capacity, single phase, and up to 7½ ton capacity, three phase.



The new heating-cooling control panel is specifically engineered to perform the necessary intermediate switching functions of residential heating-cooling units. Basically, it is designed for use with the company's recently-announced heating-cooling thermostats that have built-in selector switches that permit the entire heating-cooling system to be controlled from one location.

With the new panel, wiring and installations are simplified and standardized, and over-all installation costs are substantially reduced.

There are two models. One, the W203A, is for heating and single stage cooling. It contains a fan relay, interlock relay, 24-volt transformer and a line and low voltage terminal board, and a size 0, 1, or 1½ motor starter. The unit is so designed that it can be applied on virtually all equipment.

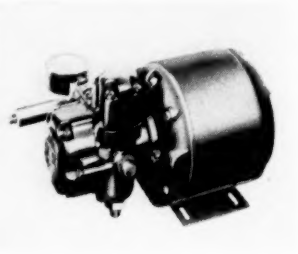
The other model, W203B, performs the same function but includes a second motor contactor for two-stage cooling. It also contains a time delay to prevent the compressors in two-stage cooling from starting simultaneously and possibly over-loading the power lines.

The panel's reduced wiring makes possible lower installation costs. When the panel is factory mounted and wired to the compressor and fan motor, the only line voltage wiring required for installations is a single 115 or 230-volt line and a ground.

More Information? Circle Item 33 on postcard, page 123

Fuel Oil Supply Pump

The addition of the Model 17336 fuel oil supply pump to its line is announced by Industrial Sales Div., Webster Electric Co., Racine, Wis.



This motor-driven pump has been designed for suspended heater installations where high lift and pressure requirements necessitate an auxiliary or supply pump. It will deliver a maximum of 30 gph with a pressure head of 17 feet above the supply pump when connected on a single pipe system, or a lesser amount as the pressure head is increased.

Capable of lifting the oil 15 feet from the fuel tank, the pump will allow any number of overhead heaters to be included in the same system, provided that their combined firing rate does not exceed the maximum gallon rating.

The supply pump is furnished with a 1/6 hp, 115-120 volt, 60 cycle motor and mounting plate, plus a self-regulating check valve and a pressure gage to set the minimum pressure necessary to the system.

More Information? Circle Item 34 on postcard, page 123

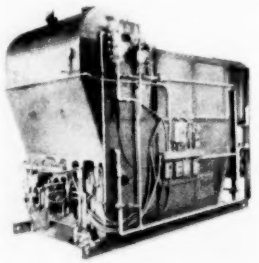
Generator Price Dropped

A major reduction in prices on both high and low pressure Steam-Pak generators in sizes of 150 hp. and up is announced by York-Shipley, Inc., York, Pa.

More Information? Circle Item 35 on postcard, page 123

Low Headroom Steam Boiler

Cross-drum boilers, providing ample power in the 100 to 200 hp. range in completely packaged units that take up less headroom because of their compact cross-drum design, are made by Mund Boilers, Inc., Los Angeles, Calif. Ability to withstand long periods of overload is an outstanding feature of the cross-drum model.



The cross-drum design is exceptional for extra-fast firing, it is reported, with heating surface of 7½ to 8 sq. ft. per horsepower to insure maximum efficiency and fuel economy, augmented by Fiberglas insulation throughout. Straight, steeply inclined water tube construction with extra circulators provide positive, fast circulation so that boilers reach full capacity in less time.

Firebox, pre-cast refractory walls and the complete water supply with pump, motor and tank are all installed at the factory before shipment. Each boiler is supplied as a complete unit, skidded and pre-piped, ready for operation after fuel and water lines are connected.

More Information? Circle Item 36 on postcard, page 123

Unit Fire Protectors

Self-contained units providing fully automatic fire protection, Firetox, quickly and easily installed, are available from Standard Safety Products Co., Lansing, Mich. The units are hung from the ceiling on a bracket (furnished) and requires no other parts. No additional piping or alarm systems are needed.

The extinguisher goes into action automatically when temperature rises to 165 F. Its solder fuse melts, releasing carbon tetrachloride as a vapor that settles over the fire like a blanket. There is no water or chemical damage and the action is non-toxic.

Because of simplicity, small size and relatively low cost, the units are practical for industry, hotels, and institutions, garages, homes, commercial vehicles and powerboats.

More Information? Circle Item 37 on postcard, page 123

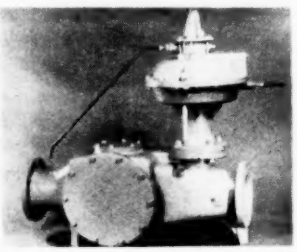
Industrial Ventilating Fans

Corrosion-resistant exhaust ventilators for use in industrial plants and laboratories are produced by American Agile Corp., Bedford, Ohio. These exhaust ventilators are fabricated throughout from unplasticized polyvinyl chloride which offers high structural strength and outstanding chemical resistance to most corrosive vapors encountered in industrial operations, including nitrous gases. They are of fully welded construction, and are available in four different sizes, ranging in capacity from 250 to 1670 cfm.

More Information? Circle Item 38 on postcard, page 123

Pilot Loading Gas Regulator

A new pilot loading system designed to increase the safety and versatility of its standard 014 gas regulators has been introduced by Rockwell Mfg. Co., Pittsburgh, Pa. A pilot-loaded regulator of this type, the manufacturer reports, can deliver more than three times the outlet pressure obtainable with a standard weight loaded regulator—10 psi as compared with 3 psi.



As a safety feature of the new system, the valves automatically close in case of inlet pressure failure or diaphragm case breakage. The mechanism is enclosed to discourage tampering.

The greatly increased pressure range of pilot-loaded regulators extends their field of application to include many installations that formerly required a high pressure regulator. The pilot-loading system provides highly sensitive regulation throughout the range of operation.

More Information? Circle Item 39 on postcard, page 123

Pipe Identification

An easily installed pipe identification system that requires no protective coating, cleaning or maintenance and uses labels custom-made of Vinylite plastic rigid sheet, is being produced by Wilmington Plastics, Inc., Wilmington, Del. Corrosive conditions, temperature and humidity changes to which pipe labels are usually subjected have little effect on the plastic, which resists moisture, oils, greases, acids, alkalies and most other chemicals. The rolled label is easily spread by hand and allowed to spring closed around the pipe.

Colored and worded to fit requirements, the label is easy to read at a distance and from any angle. Use of these pipe labels helps speed up repairs, promotes safety, aids in personnel training and eliminates loss of time spent searching for specific pipes or valves. Available in 6, 8, 10 and 12 inches in length to fit any size pipe up to 30 inches in diameter.

More Information? Circle Item 40 on postcard, page 123

Drafting Template for Fittings

A pipe fitting indicator drafting template made to scale for professional use and conforming to all pipe line graphic standards, is available from Graphic Indicator Co., Los Angeles, Calif.

Designated the Cassel pipe fitting indicator No. 253, it indicates ⅛ to 12-inch I.D. pipe fittings in scales of ⅛, ¼ and ½ inches. The indicator is suitable for detailing, general layout, and designing of all double line industrial and commercial pipe line systems where various sizes and types of pipe connections are used.

Actual size of indicator is 5⅜ x 9⅞ inches, made of rigid translucent plastic that stays flat with a no-glare and non-slip surface.

More Information? Circle Item 41 on postcard, page 123

Fan and Limit Controls

A fan and limit control incorporating new features is introduced by Cam-Stat, Inc., Los Angeles, Calif. Either unit is available without housing for separate mounting, which offers economy in price and installation expense.

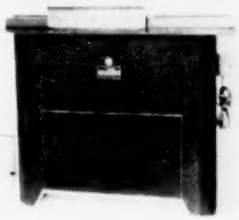
Among the features claimed are extreme sensitivity, due to low mass of bimetal actuator, assurance of clean snap-action in the switch, and no creeping or changes in settings or differentials over a long period of use. Additional features are compactness of design which facilitates integral mountings and a wide variety of settings and differentials, both fixed and adjustable.

Fan control rating is ½ hp and limit control rating ½ hp at 120 or 240 volts. They are available with either 3 or 7 inch bimetal actuator extensions. The controls are produced with housings as individual controls or in combinations, or without housing for mounting in the customers' own conduit boxes.

More Information? Circle Item 42 on postcard, page 123

High Speed Lock Rolling Units

Two high speed lock rolling machines, the Model 20 for 20 gage metal and Model 22 for 22 gage, are announced by Flagler Corp., Detroit, Mich.



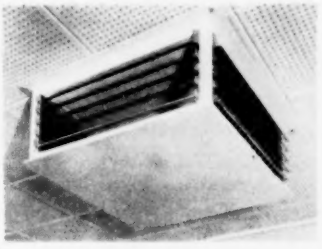
Both machines provide greatly increased output over existing models. Pittsburgh type lock can readily be formed on 20 or 22 gage stock at 50 ft. per minute. Over 1,000 drive cleats per hour can be produced with no special skill. Many other locks, flanges and shapes can be formed in sheet metal with speed and uniformity.

Both models feature: Six pairs of powered forming rolls or roll dies, no idler rolls, gears of case hardened steel, closed end roller bearings to keep out dirt, 75% more feed gage area. Material cannot creep under feed gage, motor and drive enclosed in sturdy cabinet base, overload controls protect motor. Bulletin 353 is available.

More Information? Circle Item 43 on postcard, page 123

Evaporative Cooler Diffuser

A low cost diffuser for evaporative coolers is announced by Ashburn Supply Co., Culver City, Calif. It is intended for ceiling installations in residences and commercial buildings.



The diffuser is designed in three models to fit all duct sizes for roof mounted evaporate coolers in all makes to 6500 cfm. It is of 26 gage cold rolled steel and is provided with a cone interior bottom. The unit is finished in ivory baked enamel, and its aluminum painted louvers are reversible if non-vision appearance is desired. One screw at each corner is all that is required for the simple installation. A feature is the sliding damper panel, which may be inserted during the winter time to block off drafts.

Model 16, 5 inches deep by 15½ inches square, can be used with 10, 12 and 14 inch round pipe and small size coolers and is priced at $8.50. Model 18, 7 inches deep by 20 inches square, fits duct sizes to 18 by 18 inches and is priced at $10.50. Model 22, 7 inches deep by 24 inches square, fits duct sizes to 22 by 22 inches and is priced at $12.50.

More Information? Circle Item 44 on postcard, page 123

Filter-Valve for Oil Tanks

A new fuel oil filter, the Unifilter 75, is announced by Unifilter Co., Farmington, Mich. It is a compact fuel oil filter and 4-way control valve assembly designed to connect one, two, or three storage tanks to one or more gravity type burners. It includes a water trap, washable cartridge, and is self-venting.

Fuel can be drawn from any one tank by turning the valve handle to any one of three built-in, threaded inlets. As the desired inlet is opened, the remaining two are tightly sealed, preventing loss or overflow of oil within the filter body.

The unit is quickly and easily installed by screwing the externally threaded one-half inch main inlet into the outlet hole of the center tank. Two additional inlets with one-quarter inch standard pipe threads can be easily connected with tanks at either side using copper tubing or iron pipe, or they can be left plugged. A threaded outlet connecting directly to the fuel line supplies clean oils to the burner.

Along with this integral oil control system, the unit features a Monel 100-mesh wire screen cartridge washable in any suitable solvent. A built-in water trap located at the bottom of the filter body combines with this all-metal cartridge to protect vital carburetor parts and burner nozzles from tank condensation moisture.

Due to its self-venting design, the device prevents formation of air pockets in the filtering area which directly result in oil stoppages. Air is automatically vented back into the storage tank before it can build up or impair efficiency.

More Information? Circle Item 45 on postcard, page 123

New Insulation Line

A new standard line of Aerocor-type products, designed for specific markets and uses, is announced by Owens-Corning Fiberglas Corp., Toledo, Ohio. Heretofore, Aerocor, a superfine wool, as downy resilient blankets had been cut and shaped for various applications in several fields.

The new line, which will save warehousing space for all factors concerned, includes: Aerowrap, a resilient, lightweight Fiberglas blanket for wrap-around insulation of pipes; flexible duct insulation, a lightweight fine fibered blanket-type insulation for exposed or concealed, hot or cold air ducts; Sonocor, a lightweight sound absorbing medium for use with metal pan acoustical systems.

Also included is metal building insulation, a resilient, lightweight, thermal and acoustical insulation with adhered facing, designed for application in prefabricated metal buildings; flexible duct liner, a fiber insulation, lightly coated on one side with compounded neoprene, for use as a sound absorbing material and thermal insulation for application to the interior of warm air or air conditioning ducts; appliance insulation, for installation in refrigerators, water heaters, ranges, boilers, bakery ovens, roasters and other appliances; furnace insulation, a lightweight, resilient and thermal fibrous glass insulation faced on one side with .0007 inch aluminum foil. The foil is adhered to the furnace insulation by a high temperature adhesive.

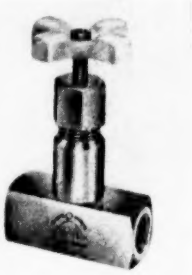
In addition, there is air conditioning equipment insulation, a flexible, fibrous glass product for use as insulation in air conditioning equipment. The basic material is coated with neoprene to prevent exfoliation or delamination at air velocities to 600 feet per minute.

The line includes a variety of other insulations for specialized uses.

More Information? Circle Item 46 on postcard, page 123

All-Steel Needle Valve

An all-steel needle valve for working pressures up to 10,000 psi has been developed by Jas. P. Marsh Corp., Skokie, Ill.



Valve bodies and valve stem guides are machined from heavy bar stock steel, and are joined into a sturdy one-piece construction by a Marsh process known as Conoweld. The fusing of the valve stem guide and valve body into an integral unit provides a positive leak proof joint and eliminates the danger of the valve stem guide becoming loose while unscrewing the valve stem.

The packing used is of Marpak, tailor-made to fit the extra deep packing space. Clean and easy to remove and install, this one piece molded packing produces a leak tight seal around the valve stem without binding, permitting easy operation of the valve at all times.

More Information? Circle Item 47 on postcard, page 123

Continuous Boiler Blow-off

A system of continuous boiler blow-off that provides safe removal of boiler water impurities without unnecessary heat waste is offered in its new orifice meter by Madden Corp., Chicago, Ill.

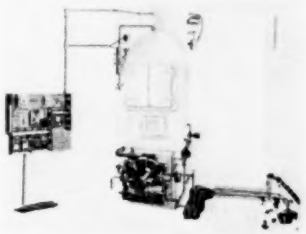
The object of the new system is to continuously remove high percentage of the foreign solids present in all waters and which tend to accumulate in boilers due to evaporation. The orifice meter is claimed to be the only way to maintain this accumulation efficiently yet economically at a safe level below the critical point at which wet steam and priming develop.

Intended for maximum accuracy of blow-off, the meter is designed to provide the right rate of flow required for every type of boiler regardless of water condition or evaporative capacity. Connected at the surface, the unique flow control unit continuously drains the proper amount of water from the area of greatest concentration of impurities. This system is said to result in tremendous savings by eliminating unnecessary waste of water and fuel.

More Information? Circle Item 48 on postcard, page 123

Industrial Fuel Burning System

A completely factory-coordinated industrial fuel burning system, which makes available a packaged system for the conversion of large boilers to oil or gas firing, has been developed by the Industrial Div., York-Shipley, Inc., York, Pa., designated as the F/C system.



The system is factory engineered, factory planned, and factory processed. Built around the York-Power burner for oil or gas firing, the system includes controls mounted in panels and wired to terminal strips for easy connection, factory engineered windbox assembly and refractory ring to guarantee quick installation, fuel oil heaters, and trim.

The rotary burners, oil or oil-gas-fired, are available in a complete range of sizes from 18 to 400 hp. The windbox assembly is of heavy boiler plate sized to provide the proper amount of secondary air for efficient fuel burning and with all burner mounting holes cut. This unit reduces the combustion chamber considerably and simplifies its construction by eliminating checkwork and ring walls.

The combustion refractory ring for installation behind the windbox in the combustion chamber is factory precast of high temperature refractory and is sized to provide proper combustion air. Control panels include five different types—main control panel for primary burner and flame control, induced draft fan panel for control of any size or make of induced draft fan, master and draft controls, and stock thermometer and draft indicator panel. All of the control panels are constructed of 12-gage steel with hinged and flanged covers. Knockouts are provided for easy installation. Main control panels are finished in two types, one for use with R-161 controls, the other with FP-2 flame control equipment. Other controls on this panel include disconnect switches, toggles for quick control, and necessary fuses and relays.

Also included is the tank heater for recovering hot oil being returned by burner and preheating oil in tank, fuel oil pump sets, fuel oil heater assemblies of either below-the-water-line or steam type, and trim assembly of valves and gages for suction and discharge piping at burner.

More Information? Circle Item 49 on postcard, page 123

Single Retort Underfeed Stokers

The Fluid-Ram hydraulically driven and controlled stoker is added to complete the line of single retort underfeed stokers manufactured by Erie City Iron Works, Erie, Pa.

This compact stoker provides unobstructed access to fire, sifting, and ashpit doors. The hydraulic fuel feed control offers a wide range of fuel regulation, making the unit suitable for automatic combustion control where wide load range operation is desired.

More Information? Circle Item 50 on postcard, page 123

Powder Actuated Tool

A new plus-power Jobmaster powder-actuated fastening tool, which does medium-duty fastening into steel and concrete at one-third less operating cost, is announced by Ramset Fasteners Div., Olin Industries, Inc., Cleveland, Ohio.

The tool has a barrel diameter of $\frac{3}{8}$ inch as compared with $\frac{1}{4}$ inch for the regular model which has been in production for several months. The new larger-diameter barrel is being produced as a separate lower assembly so that many tools already in use in the field may be fitted readily with the new barrel assembly. Thereafter, the tool uses the regular or the Plus-Power barrel assembly inter-changeably, depending on the requirements of any particular job.

The tool has proven especially valuable on plumbing lines up to 4 inches in diameter, refrigeration insulating and piping, heavy ducts, overhead sprinkler systems, and other applications.

More Information? Circle Item 51 on postcard, page 123

Plastic Pumps, Valves, Fittings

Extension of its product line to include plastic pumps, valves, accessories and fittings is announced by The Cooper Alloy Foundry Co., Hillside, N. J. The company has acquired an interest in Vanton Pump Corp., New York, N. Y., producers of the patented corrosion-resistant "flex-i-liner" plastic pump and a unique line of polyethylene valves, and fittings.

More Information? Circle Item 52 on postcard, page 123

Audio-Video Noise Finder

An audio-video model of the Elec-Detec portable electronic instrument designed for locating noise sources in all types of mechanical equipment, is introduced by Anco Instrument Div., American Name Plate & Mfg. Co., Chicago, Ill.

The unit, known as Elec-Detec Model V includes a milliammeter for checking sound impulses visually, in addition to the standard headphones for audible operation. The combination, it is stated, enables the operator to see as well as hear the location of the source of trouble in bearings, pistons, gears, and other moving parts.

The performance of the new video unit is assured by the use of a highly stable germanium crystal diode in the circuit. This crystal serves to rectify the current to record the electrical impulses accurately on the d-c milliammeter, and to provide the wide frequency response required, it is pointed out.

More Information? Circle Item 53 on postcard, page 123

What Would You Do?

Replies to engineering and operating problems of interest to the industrial plant engineer

Conducted by
NATHAN N. WOLPERT
Associate Editor

WHEREVER products are manufactured from a moist mixture or substance, or some slurry or compound must be freed of a large part of its water content, a drying problem exists. There are so many methods for drying and such a variety of drying equipment that deciding on the equipment to be used can be far from simple. The basic factors in determining the equipment to be used are outlined in this discussion.

Should you have some comments that you would like to add to the coming discussions, or if you have a problem of interest to industrial plant engineers that you would like to see treated in this department, you are invited to write to the Editor. Such letters are welcome.

Here is the Problem

We will soon be faced with the problem of drying a sludge and also granular material. We would like to know what type of equipment to use for this drying. What determining factors are important in deciding on the proper equipment?

This Month's Problem

Many factors will enter into the final selection of a dryer. Before a preliminary selection is made of the type of drying equipment to be used, it is best to list as many as possible of the controlling factors and in that way eliminate a number of the different dryers from consideration. Following are typical important factors:

Properties of the Material Being Handled. The physical characteristics of the wet material are of prime importance and whether it is liquid, sticky, or free-flowing. Similarly the physical characteristics when dry, should be known. The toxicity and flammability of the material must be considered from the safety standpoint. The corrosiveness and abrasiveness of the material, both in the wet and dry conditions, will determine the material from which the dryer must be constructed. Particle size and shape will often determine the methods by means of which the material can be successfully handled. The value of the material being dried may influence the final decision since a high cost material will preclude the use of dryers from which yield losses may result.

Drying Characteristics of the Material. The type of moisture associated with the material may influence the dryer selection. It is important to know whether the moisture is (1) all on the surface of the material (sand, crystalline salts); (2) dissolved in the solid (soap, some polymers); (3) absorbed on the solid (silica and alumina gels); (4) in the form of a hydrate; or (5) any combination of these possibilities. The initial and desired final moisture content will directly determine the size of the equipment required. Permissible drying temperatures should be known. This is often difficult to evaluate, since the permissible drying temperature is almost always a function of drying time. Heat-sensitive materials can often be higher in spray or flash dryers, where the drying time is a matter of seconds, than would be possible in tray dryers where the drying time is a matter of hours.

Flow of Material to and from Dryer. In this category the most important factor is the quantity of material to be handled per unit of time. The operation prior to and following the drying step should be known. Whether these associated operations are batch or continuous in nature may influence the selection of the drying equipment. Also, the possibility of combining drying with either a dewatering or grinding operation should be considered.

Product Qualities. Since the drying operation is frequently the last operation in a process prior to packaging and final marketing, the quality of the product from the dryer may be fixed either by existing or proposed product specifications. These specifications may cover a wide variety of properties. Shrinkage of the product after drying (cloth) or during drying (pottery and wood) may be important. Many products as pharmaceuticals, pigments and food products must be free from contamination. Uniformity of final moisture content may influence subsequent use of the material. Specifications on product decomposition must always be considered with temperature-sensitive materials. The state of subdivision of the

Problem for the Coming Issue

Most manufacturers of unit heaters (steam) show suggested piping hookups in their catalogs and usually they include one or two arrangements omitting a return trap. In commercial and industrial work, most unit heaters are connected with two-pipe steam systems under positive pressure and the return line is usually high. When and where is the elimination of traps in unit heater installations justified?

product and its uniformity will often influence product salability or end uses. Bulk density of the product will have an important bearing on packaging method and shipping costs.

Recovery Problems. Two principal recovery problems may be involved in a drying operation. The first is the recovery of any dust which may be formed. If toxic materials are handled, dust control will be required as a personnel safeguard. The second recovery problem is met when handling solvent-wet materials. A loss of solvent equivalent to just 1% of the solvent on the material when drying, may represent an expense greater than the cost of the entire drying operation.

Before the final type and size of dryer for a given material can be selected, it will almost always be necessary to conduct drying tests with equipment simulating that of the plant size dryer being considered. Insofar as possible, these tests should be conducted for all types of dryers deemed applicable, after the preliminary comparison. These tests will permit an accurate estimate of the plant scale size of each dryer and will also furnish some material for product evaluation.

Almost all of the large and reputable vendors of drying equipment maintain laboratories in which drying tests can be run, often at no expense to the prospective customer. It is always wise, whenever possible, to avail oneself of these facilities.

S. J. Friedman
Engineer, Textile Fibers Department
E. I. du Pont de Nemours & Co.
Camden, S. C.

Previous Problem

The following is an answer to a previous question regarding methods used for welding stainless steel pipe for both shop and field work where the weld is to be made manually and if there are any precautions to follow to insure a good weld:

Since most of the welding methods are applicable to the joining of stainless steel, the best method depends to a large extent on the particular application. A major portion of the stainless steel piping for such applications as steam turbine and oil refinery installations is fabricated by the electric metal arc welding process using heavily coated electrodes. The gas and inert arc welding processes are used to a great extent in the fabrication of light sections of austenitic materials and the inert gas shielded metal arc welding process is gaining popularity for fabricating heavier sections.

In the fabrication of stainless steel piping with the metal arc process, it is general practice to weld with the material at room temperature and to allow the area to be welded to cool to below 300F, after each pass of weld is deposited.

The production of good welds, of course, requires the selection of the proper electrode for the base metal composition, proper joint preparation, and a well-trained operator.

A. C. Ward
Electrode Sales Engineer, Welding Dept.
General Electric Company
Fitchburg, Mass.

A Satisfactory Method for Heating Basementless Houses

A study was made to determine, if possible, a practical answer to the problem of how to satisfactorily heat the basementless house, particularly the ones with concrete slab floors. In many areas, it was learned, the accepted practice has been the use of the warm air perimeter type of heating system.

The findings of this research project was reported at the semi-annual meeting of the American Society of Heating and Ventilating Engineers at Denver, Colo.

This investigation, a part of the cooperative project jointly sponsored by the Engineering Experiment Station of the University of Illinois and the National Warm Air Heating and Air Conditioning Association was reported in a paper on Performance of Warm Air Perimeter-Loop and Perimeter-Radial Systems in a Residence. The authors, all of the University of Illinois, are H. T. Gilkey, research associate in mechanical engineering, R. W. Roose, research assistant professor in mechanical engineering, and M. E. Childs, research associate in mechanical engineering.

The overall performances of two types of perimeter-loop systems were studied previously in a project entitled Warm Air Heating Research Residence Number Three.

The paper presented at the Denver meeting dealt with one phase of this research which was conducted in a low-cost basementless house with a concrete slab floor. The perimeter-loop systems used consisted of a six-inch diameter warm air duct embedded in the concrete slab in the form of a single loop around the periphery of the floor, and five six-inch diameter feeder ducts connecting the perimeter loop with a subfloor plenum below the furnace.

The perimeter-radial systems used consisted of six, six-inch diameter ducts which connected the registers directly to the subfloor plenum. Both deflecting and straight-vaned registers were used with each duct arrangement.

Conclusions

The following observations, pertinent to this study and of general interest to the public, were made by the authors:

(1) The room air temperature differentials were smaller with the loop system than with the radial system.

(2) The use of deflecting registers caused smaller differentials than did the straight-vaned type.

(3) The floor-surface temperatures were higher and more uniform in pattern, and the heat emission from the warmed floor was greater with the loop system than with the radial system.

(4) The fuel consumption was less with the radial system than with the loop system.

Why Honeywell Customized Temperature Control is a wise investment for apartment owners

Increased "rentability" will be an important factor in the years ahead

Lots of sun, fresh air, room for children to play—these all appeal to tenants at Meadowbrook Apartments, a garden apartment development in Indianapolis, Indiana.

And so does Honeywell Customized Temperature Control that gives each tenant *individual temperature control*, an advantage unfortunately not enjoyed by many apartment dwellers.

For at Meadowbrook there's a thermostat in each and every apartment.

When you talk to tenants about the heating system and the individual temperature control they enjoy, they agree both are the best they've ever known, that they're equal to what you find in the finest private homes.

And the resident manager of Meadowbrook, Henry C. Dickson, feels that Honeywell Customized Temperature Control definitely helped increase "rentability" at the time the buildings were finished.

What's more, he feels Honeywell Customized Temperature Control will give him a definite competitive advantage, tenant-wise, for years to come.

The Honeywell Thermostat in the typical apartment at right is located on the wall between the living and dining areas. Individual thermostats give each tenant *his own* temperature control as he wants it and when he wants it. Result: comfortable tenants. And comfortable tenants are satisfied tenants.

For Comfortable, Even Temperature in New or Existing Buildings—of Any Size, Use Honeywell Customized Temperature Control

Whether it's an apartment, office, store, factory, school, garage—or any size building—new or existing Honeywell Customized Temperature Control can help meet your clients' heating and ventilating problems.

Once equipped with Honeywell Customized Temperature Control, they'll have an ideal "climate"—and save fuel besides.

For full facts call your local Honeywell office. There are 104 across the nation. Or mail the coupon today.

Architect J. Lloyd Allen, above, of Allen and Kelley, Indianapolis, looks on as designer R. K. Zimmerly describes how Honeywell Customized Temperature Control helped solve a knotty exposure problem. The model shows clearly the varied exposures of Meadowbrook's 37 buildings, its 647 one- and two-bedroom apartments that are located on the 50-acre tract.

Meadowbrook was designed to give families all the convenience and comfort of apartment life, yet retain many advantages normally available only in private homes.

"It's no trouble at all when it comes to maintenance," says William D. Gill, Meadowbrook's superintendent of buildings and property.

"Tenants are happy with Honeywell Customized Temperature Control because it gives them individual comfort. But for my money it's ideal because it requires very little maintenance."

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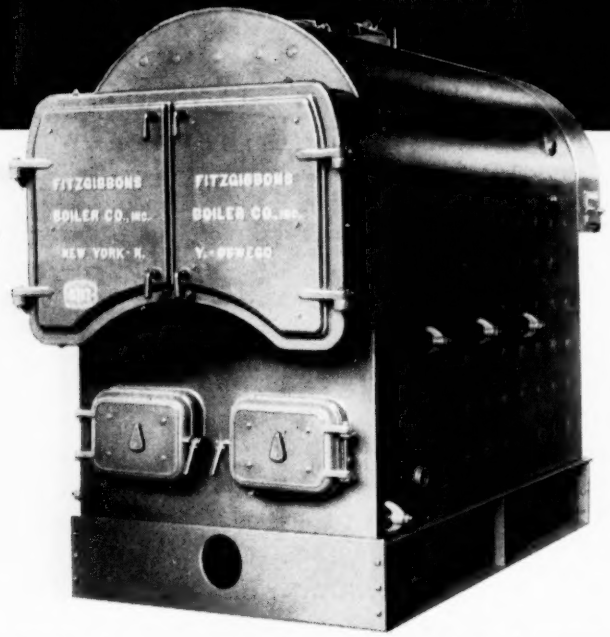

Two "D" Type boilers each rated for 18,220 sq. ft. steam, E.D.R., are installed. "D" Type boilers are available in sizes from 3650 to 42,500 sq. ft. steam E.D.R. Types for oil, gas, stoker and hand fired coal.

PLAIN TALK! Bernard Roberts, President of Sovereign Apartments, Inc., writes, ". . . this is the seventh building in recent years in which we have installed your boilers and have found them very efficient, economical to operate, easy to maintain and trouble-free over a period of years."

We think that Mr. Roberts' repeated insistence on Fitzgibbons boilers in his buildings is convincing testimony to the fact that for apartment houses, as indeed for all other buildings, "your best boiler buy is Fitzgibbons."

Full specifications and data in the "D" Type Bulletin on request. For complete details, write to the Fitzgibbons Boiler Company Inc., 101 Park Avenue, New York 17, N. Y. Ask for catalog HV-7.

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NEW CATALOGS

STEAM BOILER CATALOG

Bulletin No. A-104, a 10-page catalog on its Super-Matic Scotch Steamboiler plants, is published by Eclipse Fuel Engineering Co., Rockford, Ill. The bulletin describes the advantages, operation, applications, and construction of the units. Typical installations are shown in pictures, and a cross-sectional diagram shows the interior of a typical unit. Typical thermal efficiency test data is included along with dimensions and specifications for differently fired equipment. . . . . **Item 54**

PLASTIC CONVERSION TABLES

Designers, refrigeration engineers and servicemen are offered a handy 2 x 6 inch plastic pocket-card imprinted with frequently-used altitude and refrigeration conversion tables, by Tenney Engineering, Inc., Newark, N. J. Of value to the designer of equipment to be used under high altitude conditions, is the table converting altitude to pressure in inches of mercury, pounds per square inch, and millimeters of mercury. The other side gives pressures of Freon 13, 22, 12 and 14 over a wide range of temperatures, Fahrenheit and Centigrade. . . . . **Item 55**

SOLENOID VALVE CATALOG

Catalog No. 24, a collection of bulletins, catalogs, and specification sheets on the Asco solenoid valve line is published by Automatic Switch Co., Orange, N. J. Data, specifications, diagrams, and detailed drawings and descriptions are contained for each valve. Included are general purpose and explosion proof valves; two-way Midget valves with time delay features; three-way Midget valves with explosion proof solenoids; valves for mounting in any position; Super-Duty four-way valves with poppet-type seats and discs for continuous operating frequency of 500 times per minute; and strainers with bronze and iron bodies. A selection chart is given for quick reference in choosing the right valve for the application. . . . . **Item 56**

STEAM BOILER UNITS

Bulletin No. 509, describing and illustrating its line of complete automatic factory built oil, gas, or combination steam boiler units, is issued by Johnston Brothers, Inc., Ferrysburg, Mich. The 12-page catalog discusses unit firing equipment, ratings and guarantees, standard equipment, extra equipment, details of design and construction, and suggestions for maintenance. Tables of specifications and dimensional data are included along with illustrations of the unit and its typical applications. . . . . **Item 57**

HOT WATER STORAGE HEATERS

A new 16-page general catalog No. 5, covering hot water storage heaters and heat exchangers, is issued by The Patterson-Kelley Co., Inc., East Stroudsburg, Pa. It covers more than a dozen types of hot water storage heaters and heat exchangers. Included are horizontal and vertical hot water storage heaters, instantaneous water heaters, convertors, condensate coolers, dishwasher boosters, fuel oil heaters and instantaneous suction heaters for viscous fluids. Tables enable selection of the correct equipment for given operating condition. Typical examples demonstrate use of the tables. . . . . **Item 58**

FLEXIBLE HOSE

Its helically-wound flexible metal hose and Uniflex helically-corrugated flexible metal hose are illustrated and described in Catalog 200 published by Titeflex, Inc., Newark, N. J. It includes information for ordering flexible metal conduit and ferrules, hose assemblies, and bendable pipe. Featured in the engineering data section are charts showing frictional losses versus flow rates for metal hose and conduit. . . . . **Item 59**

NEW MOTOR STANDARDS

Bulletin GEA-5995, containing complete information on new NEMA motor standards, is available from General Electric Co., Schenectady, N. Y. The standards, passed by NEMA May 19, set up new frame dimensions for a-c motors from 1 to 30 horsepower. . . . . **Item 60**

BLIND RIVETS

A wall chart, providing in quick reference form descriptive and illustrative information and engineering data on the company's lock bolts and blind rivets, is available from Huck Manufacturing Co., Detroit, Mich. . . . . **Item 61**

BLOWER TYPE UNIT HEATERS

Catalog 403 of Airtherm Mfg. Co., St. Louis, Mo., covering its line of centrifugal fan type unit heaters is of 16 pages and contains description, photos, applications, specifications and optional features of the line. Diagrams showing typical mounting arrangements demonstrate the many ways these unit heaters can be used. Tables and charts show capacities of various models. . . **Item 62**

PIPE HANGER

A new 12-page bulletin No. 153, describing the Counterpoise pipe hanger for high temperature piping systems in steam generating stations, refineries and chemical plants, is issued by National Valve & Mfg. Co., Pittsburgh, Pa. It describes how it is possible to get accurate and efficient load supporting effort of constant value throughout the entire range of travel as the pipe expands or contracts due to temperature changes. Graphs for aid in selecting proper hangers, tables of dimensions, plus erection and field adjustment instructions are given. . . . . **Item 63**

WEATHER COMPENSATED CONTROLS

Section 1, 16 pages, of its general catalog, dealing with weather compensated control systems for hot water heating, radiant heating and warm air systems, is issued by Sarcotherm Controls, Inc., New York, N. Y. A complete line of outdoor controls is described together with technical data and typical specification form. Section 2, on Steam Heating Control Systems and Section 3, on Electrical Accessories are also available. . . . . **Item 64**

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STRESS RUPTURE DATA CARD

A data card, TDC-153, published by The Tubular Products Div., The Babcock & Wilcox Co., Beaver Falls, Pa., presents stress rupture data on B&W Croloy tubing steels and other materials designed for high temperature service... **Item 65**

GAS SPACE HEATER

Bulletin 560-60, issued by Dravo Corp., Pittsburgh, Pa., explains how a gas-fired space heater was built directly into an air conditioning duct system to eliminate the need for an expensive boiler plant. The 4-page booklet tells how the heater was adapted to form a part of the central heating and cooling facilities for a modern banking mezzanine and offices, and lists the advantages and benefits including economies of such an installation. Building heat loss and fuel cost are given..... **Item 66**

PORTABLE GAS ANALYZER

Bulletin 120 is available from Ellison Draft Gage Co., Chicago, Ill., describing its portable gas analyzer for measuring CO_2, CO, and O_2. Various components are covered in detail. ..... **Item 67**

CONTROL MANUAL

What to look for in maintaining control equipment properly is told in a new 8-page manual, Proper Maintenance of Control, Form 14X7612A, by Allis-Chalmers Mfg. Co., Milwaukee, Wis. Besides giving helpful suggestions toward overcoming the most frequent difficulties common to most electrical control devices, the pamphlet has a handy control trouble-shooting chart for quick reference showing the symptom, possible cause and cure. The back page carries a listing of 26 suggested points for checking to assure preventive maintenance of control equipment. ..... **Item 68**

GLAZING CONDITIONED HOMES

Glazing the Air-Conditioned Home is the title of a pamphlet, Form M-23, by Libbey-Owens-Ford Glass Co., Toledo, Ohio. Accurate data are presented on the transmission of solar energy through different types of glazing for windows. A discussion of both winter and summer effectiveness of Thermopane insulating glass and the role of heat-absorbing glass in the air conditioned home is included. Location of trees, trellises, service areas, and awnings in relation to window areas is also covered in the treatise... **Item 69**

METERS AND CONTROLS

A comprehensive catalog containing information on its complete line of meters, control equipment and engineering services is offered by Bailey Meter Co., Cleveland, Ohio. It is written for engineers in power plants, public utilities, and process plants. Fifteen measured variables common to power and process operations form the index for selecting appropriate metering and control equipment. Basic specifications, illustrations, and detailed literature references are included. ..... **Item 70**

WALL RADIATION

Catalog WR-C3, covering its line of wall radiation, is published by Fedders-Quigan Corp., Buffalo, N. Y. Data covers uses, engineering data, specifications and dimensions. New features of the wall radiation include interlocking fin design, channel-reinforced covers to withstand industrial and institutional service, and overlapping cover sections for quick installation on the job..... **Item 71**

STRAINERS

Bulletin 200 on its line of DuoFlo strainers for clearing liquids of objectionable solids is issued by Sheffler-Gross Co., Philadelphia, Pa. ..... **Item 72**

PIPE PUSHER AND PULLER

A four-page bulletin describing its pipe puller and pusher has been issued by Trojan Mfg. Co., Troy, Ohio. This device is a mechanism for pushing or pulling pipe underground and is available in two models, one for ½ to 1 inch pipe, the other for ¾ to 2 inch pipe... **Item 73**

ELECTRIC IMMERSION HEATER DATA

An electric immersion heater catalog that features a section of application data for calculating the power requirements for heating processing tanks has been prepared by Cleveland Process Co., Cleveland, Ohio. These data simplify the problem of estimating heat losses, determining the correct capacity needed and selecting proper heater size for tank capacity. With these factors accurately determined, it is an easy matter to establish the most efficient and economical immersion heater installations... **Item 74**

VIBRATION ISOLATORS

Vibration and noise isolation bases for fans and motors are described in detail in Catalog FB-802 published by The Korfund Co., Inc., Long Island City, N. Y. It gives illustrations, descriptions and specifications for vibration isolation equipment manufactured by the company. ..... **Item 75**

MATERIAL CONVEYING BY AIR

Pneumatic Conveying Systems for All Industry is the title of Bulletin No. 104 issued by Convair, Pittsburgh, Pa., illustrating and describing typical applications of the company's materials handling pneumatic systems..... **Item 76**

STAINLESS SHEETS

Architectural applications of the company's Enduro stainless steel, Toncan iron, Electro Paintlok, Electro Zincbond and U-Loy sheets are presented in Form ADV 592 published by Republic Steel Corp., Cleveland, Ohio. Booklet, most comprehensive, is 22 pages.... **Item 77**

WATER TUBE BOILERS

A two-page bulletin has been issued by The Morheat Corporation, Lansing, Mich., describing that company's automatic boiler-burner units using oil or gas or oil-gas. These units are of water tube construction and are available in nine sizes with capacities ranging from 880 to 9000 square feet of hot water radiator surface. ..... **Item 78**

DUCT INSULATION

A 16-page design data booklet, Form IN6-A1 for Fiberglas duct insulations has been issued by Owens-Corning Fiberglas Corp., Toledo, Ohio. It includes 40 photographs and drawings of the various rigid and flexible Fiberglas insulations for the exterior and interior of warm and cold air ducts. Also included is complete information about the new flexible duct liner, a product recently introduced by the company. This material may be installed on metal sheets before they are bent to form ducts. It is sprayed with a light coating of fire-safe neoprene to prevent erosion by high-velocity air and to reduce frictional losses..... **Item 79**

ELECTRODE BOOKLET

An up-to-date 50-page pocket guide to Airco electrodes, Form ADC-650, is offered by Air Reduction Sales Co., New York, N. Y. Over 30 different electrodes —stainless, mild and high tensile steels, cast iron, non-ferrous, low hydrogen, and hardfacing are described as to chemical analysis, procedure for welding and application. Other sections include picking the right electrode, mechanical properties and testing of electrodes, and specifications. ..... **Item 80**

PIPING ISOLATORS

Bulletin V/S, on Flexon Vibra-Sorbers, is available from Flexonics Corp., Maywood, Ill. Complete up-to-date specifications, installation instructions, and supporting data are given. Vibra-Sorbers are to isolate vibration from connecting suction and discharge lines to refrigeration and air conditioning machinery, pumps and turbines. They are supplied with copper tube ends, straight or bent, in inner diameters to fit standard O.D. copper tube sizes in the rigid piping. Typical applications are illustrated..... **Item 81**

GLASS INSULATION

A 24-page booklet, Form FL-100, Foamglas: Low Temperature Space Insulation for Walls, Ceilings, Floors, is published by Pittsburgh Corning Corp., Pittsburgh, Pa. It contains information about the many application methods, lists finishes, suggested thicknesses, insulation values and properties... **Item 82**

COAL AND OIL BOILERS

Two folders, Forms H206 and H207 on its boilers, are issued by Kohler Co., Kohler, Wis. Tney describe respectively features of the type G coal burning boiler for hand firing, stoker operation or oil burning, and the 22 boiler designed for oil firing. ..... **Item 83**

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

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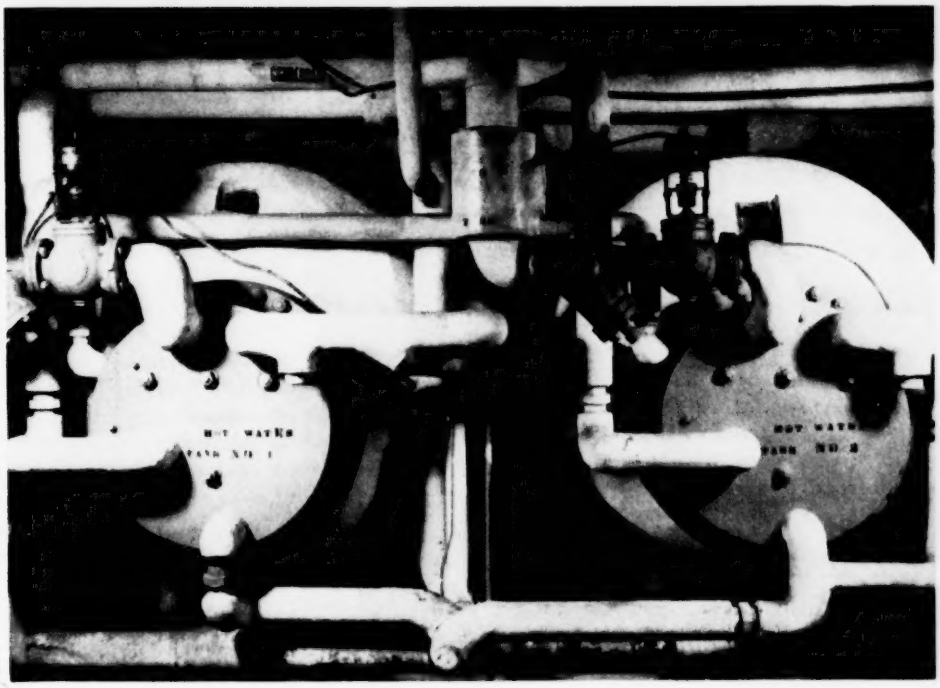

performing the same operation for 22 years to save hospital costs

At the Pratt Diagnostic department of the New England Medical Center Hospital in Boston, **p-k** hot water heaters have been performing their work successfully for 22 years and amputating part of hot water cost without anesthesia.

So satisfactory has the original **p-k** installation performed that recent additional equipment was specified **p-k**. The two new heaters are copper lined to insure clean, rust free hot water as required. Each unit heats 1100 gph from 40°F to 180°F. Each has an oversize condensate coil — 650 sq. ft. — which is cooling the heating system condensate from over 212°F to less than 130°F.

No matter what your heat exchange needs — heating or cooling — it will pay you to ask **p-k** for information now. Engineering guidance is available on call. Write now for Catalog No. 5.

P

the ***Patterson-Kelley Co.,*** *inc.*

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101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 • and other principal cities

PRODUCT APPLICATIONS

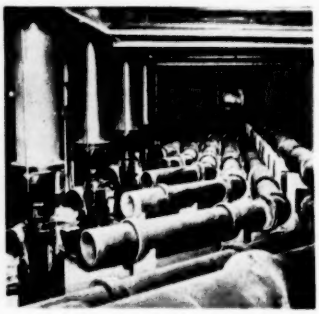
New, Unusual, or Ingenious Uses of Equipment and Materials

Conducted by WM. B. FOXHALL, Associate Editor

Clay Pipe Carries Acid Fumes

PROBLEM: Designers of the new Health Sciences Building at the University of Washington, which has been called by medical authoritites the finest of its kind in the world, were faced with the problem of venting chemical fumes from the medical and dental laboratories.

SOLUTION: A unique system of vitrified clay pipe was installed to draw acid fumes from laboratories in the lower floors and discharge them upward into the air. Individual 8- and 12-inch pipes were used for each laboratory.

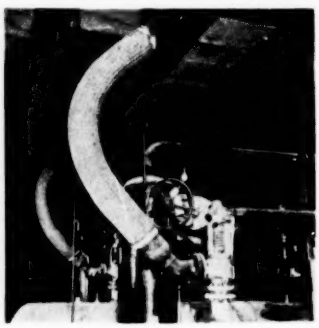


RESULTS: Hoods catch the fumes in the laboratories and direct them into clay pipe ducts. Acid-proof fans blow the fumes up to the roof and disperse them into the upper air. Vitrified clay pipe was chosen because it is immune to the disintegrating action of acids and other chemicals.

Metal Hose Used for Safety Valve Exhaust

PROBLEM: An eastern power company was equipped with safety valves projecting into a shrouded exhaust pipe. The unsealed connection made the exhaust extremely noisy, which startled workers and, in one case at least, caused a serious fall.

SOLUTION: A corrugated flexible metal hose assembly was attached to the safety valve and extended to an exhaust pipe. The flexible metal hose assembly is manufactured by Flexonics Corp., Maywood, Ill.



RESULTS: When the valve blows, a sealed unit safely absorbs sound, heat, and vibration. The company reports that the hazard to workers has been eliminated and better relations established with neighbors.

Automatic Boiler Carries Summer Load

PROBLEM: At the American La France-Foamite Corp. plant at Elmira, N. Y., boiler plant capacity for summer months was so large as to be uneconomical.

SOLUTION: A completely automatic boiler, a compact shop-assembled unit known as the B&W integral-furnace, Type FM, made by the Babcock & Wilcox Co., was set up in the engine room. The boiler is operated by push-button start and stop and will produce 8000 lb of steam per hour. It is oil and gas fired. A motor driven air compressor is installed to eliminate the use of a steam driven compressor during the summer months.

RESULTS: A saving in fuel and labor will be accomplished, since formerly a large portion of the fuel burned during the summer, averaging about 50 tons per week, was used for banking and actually served no useful purpose. Variations in steam load are handled by automatic controls.

Snow Melting Ramp Serves Garage

PROBLEM: Narrow streets and limited space for parking at Westinghouse Electric Corp.'s plant in East Pittsburgh created a congestion problem for visitors and employees.

SOLUTION: Helping to solve the parking problem is a new three-story garage engineered to accommodate four floors of cars. An outdoor ramp permits the use of the roof as a parking area. A snow melting system of wrought iron pipe coils has been built into the inclined ramps and the roof. An individual approach serves each floor. Wrought iron pipe is a product of A. M. Byers Co., and approximately 2400 ft of pipe is used in the 210 ft of inclined driveway.

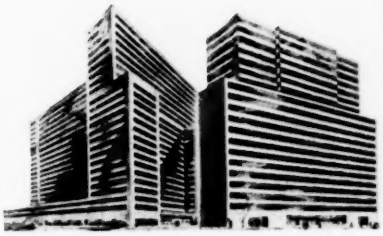
RESULTS: The snow melting system designed by Stone & Webster Engineering Corp. of Boston, provides safe year-round operation of a multi-story garage with outdoor ramps and makes roof space available as an extra parking area.

Oil Industry Tries Aluminum Pipe

PROBLEM: The oil industry has found, while installing pipe lines through swamps, over mountain ranges and other natural barriers that the weight of the pipe itself is an important factor in the cost of the installation while the resistance of the completed pipe line to corrosion from sour gas and crude oil is a factor in maintenance costs.

SOLUTION: In a decision based on test data accumulated by the Reynolds Metals Co., two aluminum pipe lines totaling six miles were installed in the Permian Basin to be used for gathering sour gas.

RESULTS: According to a Reynolds report, cost of the lines was competitive with that of steel pipe with the additional benefit of aluminum's resistance to corrosion. Light weight and ease of installation allow use of a fast automatic welding system permitting 40-ft lengths of 6-inch pipe to be lined up, welded, and lowered in at an average of one every three minutes.



The type it installed in Philadelphia's luxurious Rittenhouse Claridge and Savoy?

The advanced system recommended for the St. Francis Hospital in Lynnwood, Calif.?

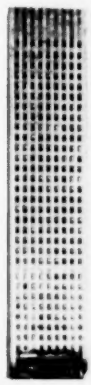
The system chosen for guest comfort in Cincinnati's famed Netherland-Plaza Hotel?

Which York system of air conditioning should you buy?

The engineering feat accomplished for New York's Empire State Building?

The battery of Turbo Compressors installed in the great new S.S. *United States*?

The all-year-comfort system chosen for the beautiful Esso Building in New York City?



YOUR BUILDING CAN TELL YOU

That's because York has taken the compromise out of air conditioning.

You see, York Engineers work with a wide range of equipment. They do not have to compromise—and try to fit a rigid system to a building or fit the building to a system.

They can recommend with broad impartiality the installation that *precisely* suits the particular requirements of the building you are air conditioning. The result, of course, is better performance, longer life, at lower initial and operating cost.

There is a York Engineering Office near you. Give them a call. There is no obligation, naturally. Or write directly for details to York Corporation, York, Pa.

YORK AIR CONDITIONING AND REFRIGERATION
HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885

Pipe Insulation Used as Flues

PROBLEM: In a 1500-home development in Midwest City, Oklahoma, built by the W. P. Atkinson Lumber & Mfg. Co., fireplaces were specified for each home. Cost of constructing each fireplace was running at approximately $600, and a means of reducing this cost was sought.

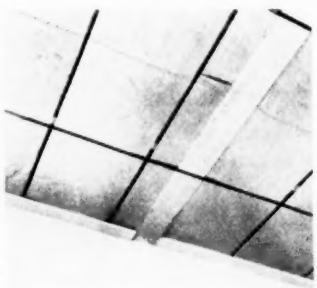
SOLUTION: By using prefabricated high temperature pipe insulation instead of conventional materials for flues, the cost per fireplace was reduced to less than $300. The pipe insulation used for the flues is Kaylo, produced by the Kaylo Division of Owens-Illinois Glass Co. After withstanding tests for nine hours in a maximum wood flame without ill effect, the material has been approved by local authorities and the FHA for use in fireplace flues. The prefabricated forms are self-supporting and rise from the top of prefabricated metal fireplaces approximately 11½ ft to the chimney.

RESULTS: Cost of installing fireplaces was reduced by 50%. Flues can be installed in less time than that required for similar installations with other materials.

Steel Strapping Supports Ceiling

PROBLEM: For a remodeling job at the Stop and Shop food store in Whiteland, Indiana, a means had to be provided for installing a false ceiling under a high arched roof.

SOLUTION: A web of steel strapping was stretched horizontally at the desired level and a blanket of glass-fiber insulation spread over the web. The supporting web was devised by Signode Steel Strapping Co. The strapping was fastened to steel structural members by driving a steel pin into wall plates at each end of the store with a powder-actuated tool. A stretcher exerted tension to create a very tight span of strapping to form the web support. After the strap web was up, blankets of Gustin-Bacon Ultralite insulation were rolled out over it.



RESULTS: The blue steel strapping and the silver of the reflective material facing the insulation make an attractive ceiling. So much favorable comment resulted that no effort has been made to paint the ceiling.

Underground Water Conditions Hospital Air

PROBLEM: In the ultra-modern $7 million general hospital being completed in Glen Oaks, N. Y., air conditioning was specified. In order to save equipment expense, it was decided to use underground water with a natural temperature of 50F without refrigeration.

SOLUTION: During the summer the underground water is circulated through ceiling and wall coils to cool the rooms while in the winter the same coils are used for circulation of heated water. An elaborate control system developed by Minneapolis-Honeywell engineer utilizes some 300 thermostats to regulate panel heating and cooling in each of the hospital's rooms and work areas. Temperature of the air fed into the rooms is controlled by an outside thermostat which regulates air temperature and humidity according to weather changes.

RESULTS: Radiant cooling is effected without aid of refrigeration. With radiant temperatures controlled, provisions for heating and cooling of large quantities of air are greatly modified, and savings result.

Clay Downspouts Stop Corrosion

PROBLEM: In many industrial plants, chemical residue dropping to the roof is washed by rain through downspouts and may cause corrosion of metal used for that purpose.

SOLUTION: According to the Robinson Clay Products Co. of Akron, Ohio, producers of Screw-Seal clay pipe, the combination of vitrified clay, threaded and permanently joined with a plastic collar, eliminates rusting and costly maintenance.

RESULTS: Surveys by Robinson show that clay downspouts are unaffected by chemical residue from roofs where industrial processes result in such deposits. Ease and permanence of installation are claimed for this product.

Plastic Controls Sun Glare

PROBLEM: In many industrial plants, the sun's heat, glare, and ultra-violet rays penetrate through large glass areas and impose severe lighting and air conditioning problems.

SOLUTION: Two anti-sun plastic protective products, a spray-on plastic film and a sheet plastic, both produced by Eastern Industrial Service, Inc. of Cambridge, Mass., under the trade name Thermoglare, have been made available. Both products are translucent and come in two colors, blue-green and frost white. They provide diffused working light while protecting against direct glare. The sheet plastic is shatter-proof and is designed for use instead of glass window panes.

RESULTS: Use of the film has materially cut air conditioning, fuel, and electricity costs in southern mills. According to the makers the products have definite applications to many industries, including textile, canning, aircraft and petroleum as well as in the home and school in areas where solar heat is a factor.

UNIT AIR CONDITIONERS

Are now available in three sizes—3, 5 and 7½ horsepower. These superior Units have extra-large refrigerating surfaces: they deliver more cooling effect per dollar, and we can prove it! Built into them are 70 years' experience.

Get the full facts on Frick Units before you buy: write for Bulletin 522. If you need a still larger air conditioning system, ask for Bulletin 504. Branches and Distributors in principal cities, the world over.

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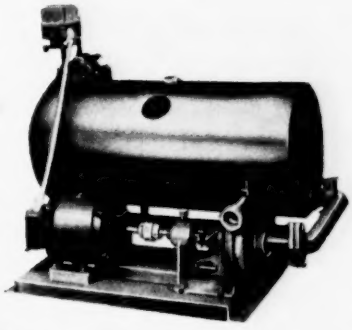
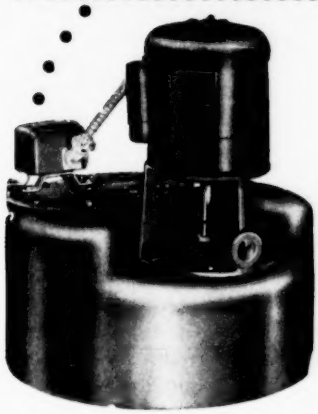
Also Builders of Power Farming and Sawmill Machinery



TYPE HS PUMP
Capacities range from 1,000 to 65,000 sq. ft. E.D.R.

. . . a long record of dependable performance



TYPE CV PUMP
Capacities range from 500 to 10,000 sq. ft. E.D.R.

Skidmore has pioneered the manufacturing of quality heating pumps for over a quarter of a century . . . by continual research and development throughout this period, SKIDMORE has set a precedent in the heating pump field for *performance* and *dependability*. There is a SKIDMORE heating pump for each and every heating installation . . . for complete information, see your SKIDMORE representative or write to factory.

SKIDMORE CORPORATION

ST. JOSEPH, MICHIGAN

Experience is my Classroom

By T. W. REYNOLDS

• AIR CONDITIONING GOES TO CHURCH

Air conditioning in church increases attendance and the number of members 10% to 15%, in one case 50%, and keeps the congregation awake to absorb more of the sermon, especially in the South. Some attend church because it is cooler than their homes and others because they need no longer be uncomfortable in church. The empty balcony fills up and extra chairs are needed.

However, churches have been almost as slow in introducing cooling, other than hand fans and cross ventilation, as they were in providing some form of heat, other than foot-warmers in early days. Heating was deemed expensive. It required the chopping and handling of wood, and furnaces sometimes burned up the church. Air conditioning is more expensive and in some cases is still viewed as a comfort not in keeping with preaching the word of God.

On the other hand, it has been learned that only the occupied levels need be air conditioned. It has also been found that ceiling and decorating costs are reduced.

Even the heat pump has gone to church, at least one has been recently installed in a church at Maderia Beach, St. Petersburg, Fla.

• CLEANING THE BOILER AND SYSTEM

The proper cleaning of a boiler and connected system is quite a subject in itself. Much has been written on the subject and there are many different opinions as to just how it should be done. Nevertheless, judging from conditions so often encountered in the field, not enough has been said.

All new heating boilers and many old boilers act as collectors of oil, grease, pipe dope, white lead and other unthought of substances. Some of these things remain in part in the heating system, the other part returning to the boiler over a period of time. High temperatures and pressures dissolving some of these materials, priming, foaming and corrosion result. Some of the coils and tubes then deteriorate and leak in a short time. Another problem is the dirt and silt which gets into a boiler during transportation and installation. Unless removed they cook into a mass of hard clay which clogs the tubes.

A chemist who has done some extensive research on boiler water treatment with a larger chemical company in California advises the results of his investigations, as follows:

"The primary problem in the proper chemical treatment of heating boilers is to completely clean the system with a chemical designed for this purpose. It should be added to the water in proper ratio, the water temperature then raised to 150F or 175F, and the chemical allowed to circulate throughout the system for from 4 to 6 hours. The drain valve should then be opened to draw off the entire contents of the system. Refill should then be made with water either warm or cold and this water circulated for 15 minutes to rinse. The system should then be completely emptied to assure a chemically clean unit.

"Water conditions may be such that a unit which has been in operation for some time may not be operating at maximum efficiency, circulating lines likewise. In our section of the country, if not in others, there are many conditions which exist in heating systems such as periodic vibration during operation, the presence of entrained oxygen, copper or iron oxide, silt, mud, silica, scale and other impurities. Here, again, is the need of some control to prevent such conditions but before such control can be effected, the impurities must be eliminated.

"An effective powdered acid compound is usually recommended for this purpose, not the ordinary cleaning compound I would use for cleaning a new installation. It should be one that will be powerful enough to remove the impurities mentioned, dissolve scale formation, and inhibit its action against metals and prevent corrosion. This compound should be added to the water when the boiler is down and in an amount based on the volume of water in the system. Then the burner should be started and the water temperature raised to 150F or 175F. Circulation should begin at once and be continued for 4 to 6 hours, after which the system should be emptied, refilled and recirculated for 15 to 25 minutes, and again drained.

"A compound should also be provided which will prevent these reactions in the future and yet work equally as well as on hard, semi-hard, and soft water. Such a compound should incorporate something for scale prevention by sequestering or suspending (rather than by precipitation) for as long as the unit is operated, or until such time as the water is replaced. The compound should further contain chemicals that absorb free or entrained oxygen so as to prevent oxidation, also some effective metal coating to prevent further oxidation and corrosion. Finally, it shoud maintain a corrective pH to neutralize the effect of acid forming gases."

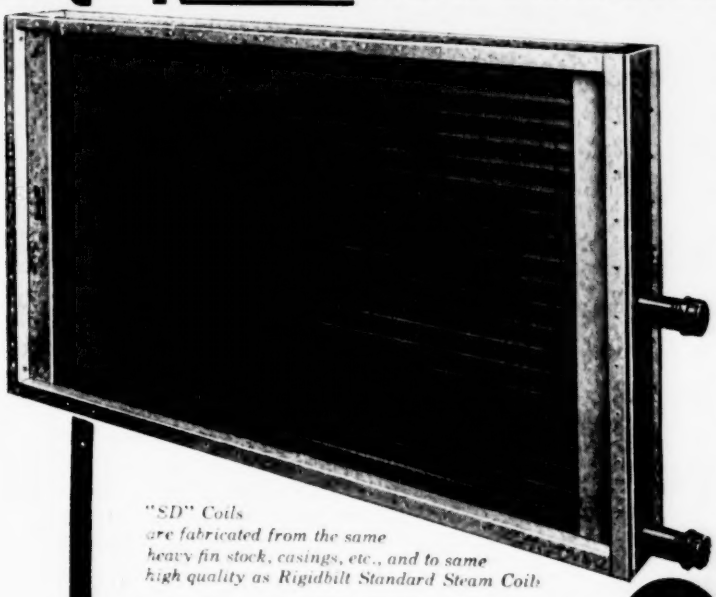
• AND WE THINK WE HAVE TROUBLES

Permafrost (permanently frozen ground) when bared for construction at Thule, Greenland, thaws out in July, so buildings are erected on insulating stilts to prevent the buildings from thawing out the ground below. Stilts are of 12 inch pipe, closing during summer to keep warm air out, otherwise open to let cold air in.

Fresh water to buildings is delivered by truck. If in

(*Continued on page* 130)

RIGIDBILT STEAM DISTRIBUTING TUBE HEATING COILS



"SD" Coils are fabricated from the same heavy fin stock, casings, etc., and to same high quality as Rigidbilt Standard Steam Coils

For heating jobs where regulated steam control is needed, RIGIDBILT Steam Distributing Coils are ideal. Uniform steam distribution is provided throughout entire length of coil, even when low throttled. Coils consist of 2 separate sets of tubes, one within the other, spaced by separators, and each free to expand or contract. Special construction keeps condensate warm.

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RIGIDBILT INC.

FULTON AND FRANCISCO • CHICAGO 12, ILL.

FAST DELIVERY!

AIR CONDITIONING & VENTILATING UNITS • UNIT & PRODUCT COOLERS • HEATING & COOLING COILS
ALSO COILS DESIGNED AND BUILT FOR SPECIAL APPLICATIONS

ONE doesn't fit ALL needs!

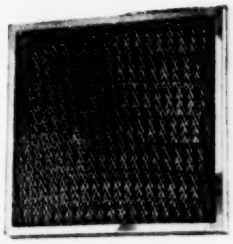
Get *Airsan* Filters ENGINEERED TO FIT THE JOB — RIGHT EVERY TIME

No filter does *all* jobs, meets every need. That's why Airsan Filters are engineered to the job to offer more effective dust collection. Airsan's expanded metal face plate acts as a lint arrestor to provide easier cleaning and servicing. It distributes air easily over the entire filter area. Provide high filtering efficiency and dust holding capacity with less resistance. Features include all galvanized construction and full bronze welded corners. Write for data.

Send for Free Bulletins

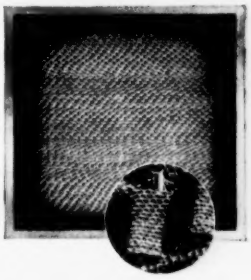
AIR FILTERS
(Low Velocity)

Viscous type, permanent and cleanable designed for industrial, commercial and domestic use. Available in 1" and 2" thickness.



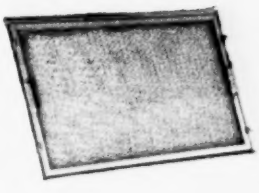
VIRO-CRIMP
(High Velocity)

Has a specially designed high velocity Viro-Crimp filter core. Hemmed edges provide a safety feature. Operates efficiently at 300 to 500 fpm. Available in 2" and 4" thickness.



GREASE FILTERS

Permanent, cleanable type Airsan Grease Filters made especially for range canopies, galleys, kitchens. Available in 2" thickness.



Air Filter Corporation

108 H NORTH WATER ST. • MILWAUKEE, WIS.
Canadian Representative
DOUGLAS ENGINEERING CO., LTD., MONTREAL

A Few Distributorships Available. Write for Details!

(*Continued from page* 128)

pipes it would freeze. This water, due to expensive distillation from sea water, is used first for washing, then for flushing toilets. Steam and fuel lines are run above ground to keep away from Permafrost. With outdoor temperatures of —60F and winds up to 150 mph, cold storage lockers must be heated to 10F.

Back to New York and the Lever House skyscraper, one finds Smith's office heated while Jone's office is being cooled. There is so much glass exterior in this building that cooling of some sections is needed even at 40F outdoors and despite the use of blue actinic glass. The sun comes and goes with the passing cloud, and neighboring buildings cast shadows. It is a problem, which, however, seems to be well handled because of adequate pre-design and intelligent operation.

• COLD TEMPERATURES DO THINGS

When the temperature drops to 32F water freezes. Everybody knows that. Downward from zero we find the household refrigerator and food locker at 40F, dry ice at —100F, and liquid nitrogen around —300F. Still lower temperatures and metals such as lead become ideal as electrical conductors. For example, a motor could be doubled in efficiency.

With low temperatures, it has been learned that aluminum can be stored to prevent hardening between time of heat treatment and machining. With dry ice, rubber parts need no tumbling barrel to smooth edges for the rubber then becomes hard like metal. With liquid nitrogen, metals can be shrunk into place, extra hard steel produced, or a machined part can be spot-cooled to reduce wear on the grinding wheel.

• WHAT'S NEW IN HEATING

The Texas Game and Fish Commission hatches out black bass at their San Marco hatchery by heating its one half acre pool, which is three feet deep to 72F during the winter months. Hot water pipe grids are set above the dirt bottom. Windbreakers reduce heat loss.

Kens Drive-In Restaurant, Long Beach, Calif., has a warm air blower warming the thinly clad lineup outdoors in damp chilly weather. Three competitors in the neighborhood have now followed suit.

Hydro Coal Transportation Company is a newly formed company for piping coal from the Ohio River to steel plants in Youngstown, Ohio. Coal will first be chopped up into small lumps. It is estimated that the coal can be pumped at one-third the present cost of rail transportation. Where to dump the water at the end of the line without providing a nuisance is yet to be determined.

Standard Oil of Ohio has moved several oil tanks one half mile to its new plant at Columbus, Ohio, one tank weighing as much as 96 tons. Tanks at destination were supported temporarily on blocks of ice which in melting slowly lowered the tanks to their final resting place.

A school in Newark, Ohio, has radiant heat in its gymnasium floor to prevent chilling of those perspiring. Similarly, it has been found desirable in rooms with high ceilings and wherever school children take naps on the floor. With radiant heat on stages, it has been found that comfort results whether the curtain is located up or down.

New rules for gas venting with tabular data are given in a booklet by William Wallace Company, Belmont, Calif. Research has discovered that a vent one size smaller than the equipment outlet gives less heat loss even though the vent then becomes hotter. Compensation for reduced capacity of the smaller diameter vent is made by increase in velocity due to hotter gases.

The vent being hotter should be insulated for safety and for conservation of heat or capacity, as should any gas vent. If not insulated it should be made of insulating materials. No basis was found for the usual claimed need for pitch and 45 degree connections.

• PLUMBING NEWS

One bathroom per house has proved a bottle neck, so, like the two-car garage, this is the day of the second bathroom. Some obtain this, at least in effect, by having separate compartments for the lavatory, toilet and bathtub, thus making several bathrooms out of one. Crane Company does this. American-Standard has designed a 4 ft by 7 ft minimum bathroom, a prefabricated shower stall which allows the use of a small space, and a receptor combination bath and shower that requires only the floor space of a shower. The receptor is made low for easy coming and going. A plastic bathtub, made of fiberglass, weighs only 17 lb.

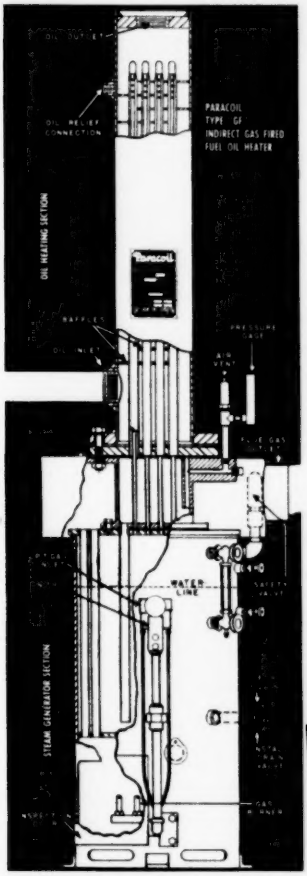
Over 300 left-handed women attended the left-handed kitchen display in Kaufmanns department store in Pittsburgh, Pa., where even the refrigerator door and range oven were made left handed. The island or central kitchen sink is another idea. American-Standard has such a sink for the middle of the kitchen floor. It is equipped with a center faucet to allow working at any of its four sides. The laundry of to-day has also been improved, made accessible upstairs, and fitted with cabinet concealed ventilator for washer, dryer and ironer. Finally, there is the two temperature (125F—130F) gas water heater.

• HOME AIR CONDITIONING MOVES AHEAD

A model three-bedroom home in New Orleans that is weather controlled by Carrier Corporation attracted 2,500 home hunters. Other developments planned are in Kansas City, Northern New Jersey and Texas. Houses are now priced at $16,300, but price anticipated for the future is only $12,000. Mass building methods will keep the cost down to that of the normal cost for non-air conditioned houses. Furthermore, air conditioning reduces overall building costs by permitting the elimination of many things otherwise often required, such as additional windows for cross ventilation, drapes, venetian blinds, movable sash screens, attic and high pitched roof.

The basement has been largely abandoned because of radiant heating and now the attic is going because of cooling. The builder is even looking with covetous eyes at the stud space as a good place for wall cooling. Nor does he like the floor space taken up by air conditioning. From the standpoint of cost he wants cooling for nothing and is apt to get it, that is, without any material increase in overall building cost.

(*Continued on page* 132)



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Paracoil TYPE "GF"

INDIRECT GAS FIRED FUEL OIL HEATER

A RADICALLY NEW APPROACH TO THE PROBLEM OF ADEQUATE OIL PREHEATING UNDER ALL OPERATING CONDITIONS!

The Type "GF" Oil Heater is an integrated self-contained steam vapor generating exchanger using gas as its primary heat source.

However, the gas flame does not come in contact with the tubes containing the fuel oil. Instead, vapor from the lower steam generating section does the actual oil heating!

APPLICABLE TO ALL TYPES OF OIL FIRED APPARATUS!

As it is not dependent upon the unit it is servicing for the means of heating the oil, the Type "GF" Heater can be applied to any oil fired apparatus, be it a steam or hot water boiler, a process oven, a dryer or a kiln!

A COMPLETE SOLUTION TO THE OIL-IN-BOILER PROBLEM!

As the Type "GF" Heater is in no way connected to the steam or water space of any boiler it may be serving, there can be no possible contamination of the boiler heating surfaces in the event of an oil leak in the heater.

CHECK THESE FEATURES!

Completely factory assembled • Easy to install anywhere, even outdoors • Requires only minimum of floor space • Economical to operate • Wide range of oil heating capacities • Burns any specified type of gas fuel High oil temperatures at all times • Operation unaffected by normal variation in viscosities of oils being heated • Reduces oil consumption through improved fuel combustion.

THE PERFECT HEATER FOR:

- Low temperature forced hot water heating systems on No. 6 oil.
- Plants with starting difficulties after week end shutdowns.
- Supplementing inadequacies in present oil preheating systems.

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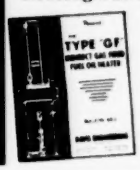

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WESTERN ENGINEERING & MFG. CO.

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Radiator Traps Built to Last

The above picture shows Chief Engineer William Hillner of Northern Hotel, Billings, Mont., pointing to one of 1281 Sarco type H Radiator Traps which have been in successful service in the hotel for 10 years.

"We have replaced not more than a half dozen elements" says Mr. Hillner, "That's why we again ordered Sarco heating specialties for our 1951 addition of sixty-three rooms."

"We won't accept substitutes."

Yes, you can buy Sarco with confidence. Each trap, before shipment, is carefully tested under actual working conditions.

Sarco Heating Specialties include also radiator valves, air eliminators, boiler return traps, temperature regulators and strainers. Write for Catalog 150-7 to **Sarco Company, Inc.** Empire State Bldg., New York 1, N. Y. No obligation of course.

Advt. 609

(*Continued from page* 130)

Cost of cooling itself is likewise reduced by the use of fewer windows and the absence of bedroom windows on late sun walls. With no need for cross ventilation, windows can be set high, thereby providing a better placement for furniture. As for the house owner, when cooling does cost him more, the thing to achieve is to make him want to pay for it, to recognize it as a necessity and not as a luxury. It is not enough that the seller is convinced that he needs it.

Some think that heating separated from cooling may be cheaper than when combined and some feel that central units are more costly than units to install in old buildings. Sometimes a building is not wired to take the additional load of air conditioning equipment. Incidentally, Fedders-Quigan is developing a room cooler to provide supplementary heat for a room. It is pointed out that a cooling unit in a living room permits the use of a large living room window. A cooling unit in the living room does keep one from going to bed earlier, so one usually ends up with another unit in the bedroom.

Recent comment has also been made to the effect that year-round air conditioning has all around advantages such as keeping service installation crews together and allowing them to service ahead of the start of each season. It does avoid the usual last minute rush to service and therefore tends to give better service.

• DEHUMIDIFICATION

Dehumidification of a pipe gallery in a filtration plant in Chicago, formerly at 93% relative humidity, is returning much of the original expenditure within a short time. There is now less corrosion of pipe and wiring and less painting required since paint does not peel off of metal surfaces as readily. Formerly, there was considerable maintenance, especially so because it took more time to work amid cold and damp surroundings.

Dehumidifiers are now widely used in basements including recreation rooms, closets, storage rooms, bank vaults, warehouses and candy kitchens. They are also used to dry out new construction and to keep dampness down for newly plastered and painted walls. In furniture storage they keep veneer in place on furniture.

• RELIEF FROM RADIANT HEAT IN INDUSTRY

To-day's worker demands that he labor without discomfort. Often of more importance in terms of dollars is the heat effect on the equipment with which he works, such as electrical motors, meters, fuses, and connected wiring, as well as the removal of excess heat in the most economical way. In some cases its re-use results in even greater economy. The problem could be more simplified were it not that rising costs require minimum spaces and handling of materials. And so we often find in industrial plants and processes hot things rather close to things which should be kept cool.

First attempts to provide relief were fixed or adjustable air outlets, sometimes at the end of a hose which could be moved by the foot where and as wanted. Generally the necessary air movement became too high or the air was overcool while evaporation of moisture lowered the vitality of the worker. Insulation of hot metal parts helped, but use of insulation is limited by operational methods. Protective or reflective clothing is often uncomfortable, although a wet towel around the upper part of the body may afford some relief. Facial creams are sometimes used.

Ventilation is often sufficient if the hot areas are but relatively few. In many cases, the streamlined continuous ridge ventilator or roof ventilators of high capacity will serve the purpose with high pitched roofs, using cross baffles on about 15 ft centers to stop possible end drafts in windy locations. These things serve well for convected heat, and dust and mist removal. They do not always provide adequate relief to the worker where the heat from hot surfaces is largely radiant, sometimes as much as two thirds.

For radiant heat, fixed or movable screens are used where practical. Some are water cooled or their material is heat absorbent to some degree; the balance of heat being re-radiated, may be troublesome. Screens may be made highly reflective, but lose reflectivity through dust and dirt. Aluminum foil on asbestos is often used, but whatever material is employed, it should not oxidize at high temperatures and for portability screens should be light. Corrugations provide rigidity.

If a screen is placed too close to equipment requiring shielding it may radiate too much heat on the equipment. If, on the other hand, the screen is placed too close to the source of heat, this heat source may restrict heat removal by convection and shorten the life of the screen. The screen should, of course, not contact the source of heat. Considerable information on this subject was given in a paper by Bartlett R. Small, Aluminum Co. of America at a meeting of the Association of Iron and Steel Engineers.

In so far as convected heat is concerned, some means of partial heat recovery should be considered since current prices for fuel may make the first cost of heat recovery more in line than in former times. Cooler make-up air can be introduced when done at high levels and tempered on the way down. The flow through piping and ducts can be warmed.

• LIGHTER PIPE

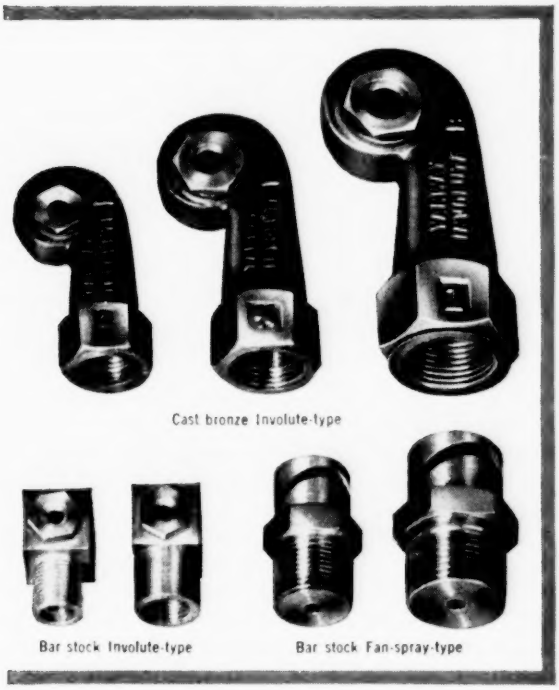
New Jersey Research Laboratory of The International Nickel Company has learned how to make cast iron so ductile it can be bent or twisted. When used for pipes, the pipes can be lighter and will expand under pressure without bursting. Similarly, the Cast Iron Soil Pipe Institute is sponsoring lighter soil pipe and fittings as part of a conservation and standardization program as well as for ease of handling. Presumably, they will be able to take the use or abuse of workmen in jobbers yards and on construction. Workmen like to toss them on and off of trucks.

Triangle Conduit & Cable Co., Inc., New Brunswick, N. J., produce several types of plastic pipe, such as flexible, semi-rigid, rigid and high impact pipe. The flexible type is further sub-divided into non-toxic, industrial and suction. Advantages of plastic pipe are freedom from the action of rust and electrolysis, lightness, flexibility, slight resistance to flow, and avoidance of rock removal. A total of 5 miles of plastic pipe was used in the water supply system at Pax, W. Va.

GET MORE OUT OF YOUR SPRAYING EQUIPMENT WITH LESS POWER

For spraying, washing, rinsing, cooling and air conditioning, Yarway Spray Nozzles will improve the efficiency of your spray equipment.

There are no internal vanes or other restrictions to clog or hinder the flow.



Cast bronze Involute-type

Bar stock Involute-type

Bar stock Fan-spray-type

Yarway Spray Nozzles are available in two types—the Yarway Involute producing fine hollow cone spray with minimum energy loss, and the Yarway Fan-spray for flat fan-shaped spray with time-saving slicing action for cleaning.

Wide range of standard sizes and capacities. Made of metal castings or machined from solid bar stock.

The 20-page Yarway Spray Nozzle Bulletin contains not only complete details on Yarway Spray Nozzles and Fittings, but also much helpful information on the many uses for spray nozzles. Ask for a free copy—Bulletin N-617.

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YARWAY / spray nozzles

For Commercial, Industrial and Institutional Installations

Sizes 1 to 60 gph capacity. Only oil burner designed especially to burn No. 5 oil without preheating. Gas, combination gas/oil burners also available.

Fuel savings up to 30% make HEV-E-OIL Burner *best buy* for you!

No wonder HEV-E-OIL Burner customers are *repeat* buyers! Hundreds of commercial and industrial buyers say HEV-E-OIL Burners helped them save up to 30% on fuel costs by *burning thrifty heavy oils.* Here's what typical owners* say:

"— since installing your HEV-E-OIL burners, we have been using the No. 5 grade oil, this has saved us approximately $900.00."

"— we formerly used 30,000 gallons of light oil per year. Now, with Cleaver-Brooks HEV-E-OIL Burners, we only consume 25,000 gallons of No. 5 oil, which gives us a saving of $700.00 per year."

*Names on request

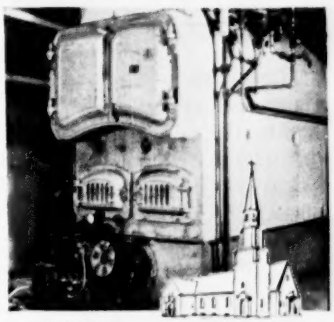
Here's how to get started cutting heating bills 30%

1 **Add up your present heating bills — then deduct 30%.** This is your approximate saving with HEV-E-OIL Burner.

2 **Write for Bulletin AD-102—** highly illustrated, with more fact-packed reasons why it will pay you to convert to HEV-E-OIL.

3 **Get in touch with your Cleaver-Brooks HEV-E-OIL dealer —** he will be glad to make a free survey without obligation.

REMEMBER . . . If you are using 6,000 gals of oil, or more than 45 tons of coal per year — the HEV-E-OIL Burner is the *best buy* for you! Write direct for name of dealer nearest you.



HEV-E-OIL Burner installed at Bay Shore Lutheran Church, Milwaukee, Wis.

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Abstracts AND Reviews

Publications abstracted in this department should be ordered direct from publisher.

PIPEFITTERS HANDBOOK

A handbook, designed to enable the pipefitter to solve problems in the shop or field in connection with pipe bending, offsetting, mitering and pipe layout, has been compiled by Forrest R. Lindsey, a pipefitter of 35 years experience. Page size is 4 x 7 inches for easy reference in the field.

Essentially the book is divided into 13 sections as follows: Figures for setbacks and length of bends, 67 pages; offsets, 9 pages; mitered joints, 21 pages; pipe data covering dimensions and thread engagement, 8 pages; screwed fittings, 17 pages; butt welding fittings, 14 pages; flanged fittings, 50 pages; valves, 7 pages; solder joint fittings, 17 pages; other pipe data, including pipe spacing, hangers, threading, soldering and brazing, 14 pages; miscellaneous data, 4 pages; mathematical data, 47 pages; and a pipefitters dictionary of 8 pages.

A large part of the book has worked out figures for setback and length of bend for a very wide range of angles and radii. Complete tables are given for a large variety of bends for radii from 1 to 48 inches. There are basic formulas to be used for the occasional case where the tables do not give the answer.

Included in the section on mathematical data is material on the use of trigonometry, trigonometric formulas and trig tables.

This is a presentation of practical data to make the book an important reference for use both in the shop and in the field. It will be found the answer to many of the probems that constantly confront the pipefitter. The information is presented to be easily understood by the man in the trade and to be easy for him to follow.

Pipefitters Handbook, by F. R. Lindsey. Bound in flexible fabrikoid with rounded corners, page size 4 x 7 inches, 282 pages. Published by The Industrial Press, 148 Lafayette St., New York 13, N. Y. Price, $6.

APPLIED ELECTRICITY

A fundamental text, excellently arranged, and unusually well written provides a sound readable basis for understanding the theory of magnetism, electrostatics, electromagnetism, and the theoretical and practical aspects of all types of electrical equipment. The treatment is such that a clear, easily scanned reference is provided for the electrical and the mechanical engineer as well as a sound, thorough presentation for the student.

A large number of simple but effectively drawn diagrams help to clarify the presentation, and to aid the reader in picking them out; important formulas are boxed off for special attention. The application of electrical theory to motors, generators, transformers, electronic equipment and measuring instruments is thoroughly covered.

Many examples are in the text and additional problems are provided for student practice.

The work originally appeared in London and was so well received there that a second edition has been published.

The following subjects are covered: Electric Circuits; Magnetism; Electrostatics; Conduction in Electrolytes; Thermoelectricity; Direct-Current Machine; Direct-Current Generator; Direct-Current Motor; Alternating Currents; Alternating Current Circuits; Electrical Resonance; Polyphase Working; Static Transformer; Alternator; Synchronous Motor and Rotary Converter; Induction Motor; Electronics; Illumination; Measuring Instruments; Units and Dimensions; and Circle Diagrams.

Applied Electricity, by H. Cotton. Second edition, cloth-bound 5½ × 8½ inches, 487 pages. Published by The Industrial Press, 148 Lafayete St., New York, N. Y. Price, $4.50.

• • •

TESTS OF THE ANTHRATUBE—The Bureau of Mines has issued Report of Investigations 4936 covering Tests of the Anthratube, by J. F. Barkley, L. R. Burdick and R. E. Morgan, all connected with the Bureau. The Anthratube was installed in a 9-room, 3-story house and during the test, this device supplied hot water for house heating and for domestic use under regular house service operating conditions, for both winter and summer. Although designed to burn pea size anthracite, it was tested with this size coal and also with Buckwheat No. 1 anthracite. Data on these tests and the results obtained are presented in this 13-page report. Bureau of Mines, Department of the Interior, Washington, D. C.

SUCCESS THROUGH WELDING—A booklet has been issued which contains reprints of articles from the *Stabilizer*, a publication issued by The Lincoln Electric Company. These articles present the stories of how 25 men have achieved success with their small businesses—the arc welding process being the foundation of the businesses described. The Lincoln Electric Company, Cleveland 17, Ohio. Price, 50 cents.

HEAT SUPPLIED FROM THE INSIDE CHIMNEY—Tests were conducted at the I-B-R Research Home during the winters of 1941-42 and 1942-43 to determine the useful heat supplied to the house by the inside chimney when the house was being heated by an oil-fired, forced circulation hot water heating system. An oil burning rate of 1.1 gallons per hour was used. Bulletin Series No. 407 discusses how the tests were conducted and the results obtained. The Engineering Experiment Station, University of Illinois, Urbana, Ill.

Designed by *EXPERIENCE*... Proven by *SERVICE*

Fairbanks Micro-Control Valves

150 lb. Bronze Globe Type

Fairbanks MICRO-CONTROL Bronze Globe Valves give you Needle Valve control and the durability of stainless steel. Here are the outstanding features of these Fig. 0525 Valves:

★Stainless Steel Plug Disc and Seat
Hardened to 500 Brinell, these parts resist corrosion, wire-drawing and abrasion due to solids in the fluid stream. The plug discs and seats are precision ground in *matched sets* to insure a perfect seal. These parts may be reground for long life.

★Two Piece Union Bonnet
Permits ready access to valve disc and seat for regrinding or replacement without removing the valve from the line.

★Radial Seat
The radial seat of the Union Bonnet is an EXCLUSIVE Fairbanks feature. It assures a tight body-bonnet joint and rigid alignment of all parts.

Fig. 0525 Bronze Globe Valve 150 lb. steam working pressure. Also available for 200 lb. and 300 lb. pressures.

Fairbanks 0525 Bronze Globe Valves are a dependable combination of precision working parts and solidly built body... designed especially for close regulation of flow.

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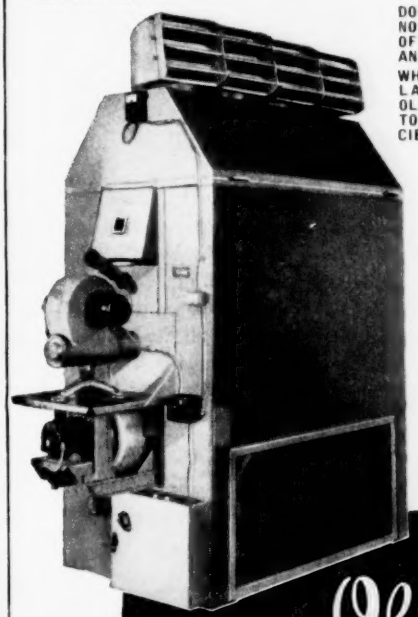
I LIKE MY JOB BUT-

I LIKE MY JOB BUT I CAN'T STAND THAT COLD BLAST EVERY TIME THE HEATER STARTS.

OLSON, THROUGH THE USE OF A SEPARATE INDUCED DRAFT FAN, ELIMINATES THE OBJECTIONABLE COLD AIR BLAST AT EVERY START. PERSONNEL DIRECTORS SAY THAT THIS FEATURE IS ESPECIALLY APPRECIATED BY EMPLOYEES.

DOLLAR FOR DOLLAR, NO OTHER HEATER OFFERS AS MUCH AS AN OLSON HEATER.

WHATEVER YOUR NEED, LARGE OR SMALL, OLSON IS THE ANSWER TO LOW COST EFFICIENT SPACE HEATING.



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Gas, Oil, Coal or Dual Gas and Oil
BROAD ST. · CANFIELD, OHIO

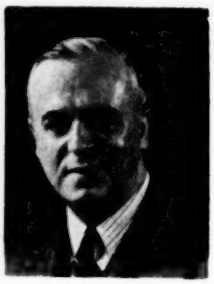
WRITE FOR COMPLETE INFORMATION AND DATA SHEET, SHOWING HORIZONTAL AND INVERTED MODELS, STOKER FIRED AND DUCT UNITS.

NEWS OF THE MONTH

CYRIL TASKER

director of ASHVE Research dies suddenly. International career marked by contributions to his field.

Cyril Tasker, 54, director of research in the ASHVE, died suddenly on May 27. Mr. Tasker had attended a meeting of the I-B-R held at Absecon, N. J. and was en route home when he succumbed to a heart attack in Warren, Ohio.



C. Tasker

He had been director since 1943 and previously for 13 years was a member of the staff of the Ontario Research Foundation. As a senior research fellow at the foundation, he carried on important investigatios relating to fuels, and a variety of problems connected with heating and air conditioning.

Mr. Tasker was born in Manchester, England and was graduated from the University of Manchester in 1923 with the degree of M. Sc. (Tech). Until 1930, when he came to Canada, he was on the staff of the British Fuel Research Board. He became a member of the Society in 1935 and had served as a member of the Committee on Research, and of the following Technical Advisory Committees from 1936 until 1943: Fuels, Insulation, Physiological Reactions, Air Conditioning in the Industry, and Sensations of Comfort. He was elected to Council in 1941 and resigned upon receiving the appointment as research director.

He had also been active in the Ontario Chapter, served on its Board of Governors, and was president for the 1941-42 season. Mr. Tasker held memberships in The Institution of Heating and Ventilating Engineers, the Institute of Fuels, The American Society of Metals, and had been a frequent contributor to technical publications in the United States, Canada, and England. His reports to the Society on the work at the Cleveland Laboratory are well known in the profession.

HOSPITAL BUILDINGS

to be subject of research coordination in effort to provide better and cheaper hospitals, BRAB reports.

A group of hospital officials met in Washington in January with representatives of the Government and the American Institute of Architects to discuss the formation of a central research organization for hospital planning. The meeting was under the joint auspices of the American Hospital Association, the American Institute of Architects, and the Building Research Advisory Board of the National Academy of Sciences.

• **AIM.**—The main function of this central organizaton would be to conduct actual research on hospital planning and to stimulate research activity among allied agencies. Another function of this unit would be to distribute up-to-date technical information on hospital design and planning, since at the present this material is scattered among many sources and is not readily available to architects, administrators, and consultants in the hospital construction field.

This conference was aimed at bringing together interested agencies and formulating a program which will be presented to foundations in an effort to raise funds for establishing this coordinating organization. The Building Research Advisory Board conducted this meeting as a supplementary activity to its Study of Conservation in Building Construction being carried out for the Defense Production Administration. In the course of this investigation, BRAB has noted many fields where cooperation among interested parties is essential in producing research criteria and getting technical information distributed to those in need of it.

Among the organizations represented at the Conference were: The American Hospital Association, the U. S. Public Health Service, the American Association of Hospital Consultants, the American Institute of Architects, the General Services Administration, The American Psychiatric Association, the Bureau of the Budget, the Armed Forces Medical Policy Council, the Defense Production Administration, various hospital administrators, the architects prominent in the hospital building field.

• **GUIDANCE.**—It was felt that this information and research center could be under the general oversight of the American Hospital Association, with policy and program responsibilities guided by an advisory board made up of representatives of the AHA, the American Institute of Architects, and the American Association of Hospital Consultants. It was hoped by those participating in the conference that the formation of this center will result in economies and improvements to provide more and better hospitals.

GIANNINI FUND

honors late assistant dean of New York University's College of Engineering. Was prominent in ASHVE.

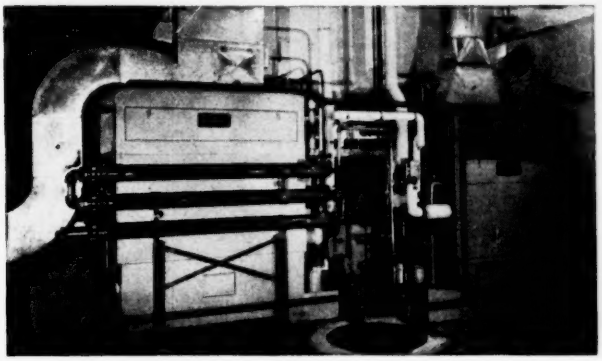
The establishment of a Mario C. Giannini Memorial Fund in honor of the late assistant dean of New York University's College of Engineering was announced Friday, May 29 by Dr. Thorndike Saville, dean of the College.

• **FUND.**—The principal of the fund was contributed by Professor Giannini's friends and colleagues in the Univer-

(*Continued on page* 138)

This NEW METHOD DRIES AIR

PRECISELY AS YOU WANT IT



NIAGARA CONTROLLED HUMIDITY AIR CONDITIONING

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

Most compact, taking less space for installation.

Inexpensive to operate because . . . no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

For complete information write

NIAGARA BLOWER COMPANY

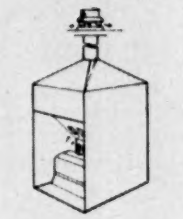
Over 35 Years of Service in Industrial Air Engineering

Dept. HV, 405 Lexington Ave. New York 17, N. Y.

Sales Engineers in Principal Cities of U. S. and Canada

You Can Be Sure GALLAHER *CERTIFIED* RATINGS mean *Peak Performance*

HERE'S WHY

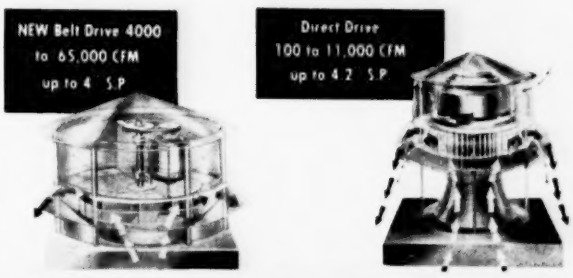


Gallaher ratings are the result of actual physical tests of the entire unit—*not* a fan wheel alone or other component, *not* interpolations of free air data, but a true picture of the unit as it operates under actual conditions.

Any other method of rating a power roof exhauster will be inaccurate. Gallaher research has shown conclusively that the errors may run as high as 50% when ratings are mere theoretical calculations.

Gallaher units with patented, built-in *scroll effect* are the only power roof exhausters which can develop high static pressures. With this feature, thousands of industrial applications are well within the range of economical power roof exhausters. They have been rated in an independent laboratory under the direction of a nationally recognized authority under the conditions prescribed by NAFM and ASH&VE.

Before you buy power roof exhausters we think you'll agree that these three questions should be answered to your satisfaction. 1. How were the tests conducted? 2. Did it include the whole unit and not a component? 3. What impartial authority conducted the tests? We think that you'll buy Gallaher Air-Vans.



Pat. No. 2536290 2588741
Pats. pending

For full information write Dept. V-7

The GALLAHER Company

4108 DODGE STREET OMAHA, NEBRASKA

GIANNINI FUND

(*Continued from page* 136)

sity and in the New York section of the American Society of Heating and Ventilating Engineers, of which he was once president. The income from the fund will be used to provide an annual award to a mechanical engineering graduate of the Evening Division of the College of Engineering who, in his under-graduate career, has demonstrated outstanding promise of usefulness in his profession.

• **CAREER.**—Professor Giannini, an alumnus of the College of Engineering, was a member of the College's teaching staff for 25 years and was assistant dean in charge of the College's day divsion from 1949 until he retired for reasons of health in July, 1952. He died on August 24, 1952, upon his arrival at Winter Park, Florida, where he intended to take up residence and where his family now lives.

Professor Giannini also had a distinguished career as a consulting engineer in the field of heating, ventilating, and air-conditioning. He was active in the ASHVE, ASME, and ASEE, and was elected to two honorary engineering fraternities, Tau Beta Pi and Pi Tau Sigma.

FLOATING SLABS

cast on job use no joists or forms. Method provides quick floors or ceilings for warm air radiant heating.

Floating slabs, which are cast on the job by a method called Floating B, use no joists or forms.

The new type of construction was developed by D. H. Butler of Products Planning Co., through the use of new high-strength densifiers for concrete recently invented by him—one of which was put on the market last year by Lee-Don, Inc. of Harmarville, Pa., under the name of Heatcrete. Slabs made by the new method can be made to span 8, 10, 12 and 14 ft so that it is suitable for both floor and roof deck construction and permits the pouring of slabs on the job.

Examining the new self-supporting floor developed by Products Planning Co. of Pittsburgh, Pa., are T. C. Ward, president, Perlite Manufacturing Co. of Carnegie, Pa., T. C. Phillips, manager of sales of Pittsburgh Steel Products Co., producers of Steeltex, and Everett Hunter and Roy Johnson of the Steeltex Division.

• **METHOD.**—The method uses a light-weight high-strength concrete to make the first arched layer over a pre-formed B section made from Steeltex, formed into arches of the length required for the span. This first layer dries to become the form to support the high-density high-strength Heatcrete panel, a comparatively thin layer forming the radiant heating or structural floor, which is poured only a few days after the first arched layer is in place.

The reinforcing of both the ligt-weight concrete and the high-density heating or structural slab are accomplished by using existing materials in a completely new manner. For example, the floor section illustrated was built to accommodate warm air radiant heat and uses a new type expanded metal heat duct to provide structural strength. The result is a truly floating floor which provides insulation and is raised off the ground to avoid moisture penetration. This type of construction is especially suited to residential buildings and structures using the curtain walls now on the market.

Initial distribution will be made through Heatcrete distributors who will carry the new densifiers and show builders how to use them in connection with the new Floating B section for self-supporting panel construction.

NEW YORK AIR

may be cleaner if Dr. Greenburg has his way. Changes in apartment house incinerators called for.

Owners of many tenement and apartment houses in New York City may have to make important alterations to their present incinerator systems, Dr. Leonard Greenburg, Commissioner of Air Pollution Control, told committees of the Real Estate Board of New York, Inc., at board headquarters.

• **CONDITIONS.**—Most of the present installations, he explained, are not equipped to operate satisfactorily all the time, and it may be necessary to shut down a large part of the city's 10,000 incinerators unless they are provided with settling chambers or secondary combustion. In installing settling chambers on roofs not built for a substantially increased load, he suggested that use of light weight panels of aluminum, transite or other similar materials, which have shown their merit, might simplify the problem.

• **LAW.**—Dr. Greenburg said that his agency already is taking action against unsatisfactory installations. The law requires incinerators in buildings of four or more stories containing at least twelve families, but where a building is surrounded by much taller structures and the incinerator has to operate in a pocket of static air, sur-

(*Continued on page* 141)

HEATING AND VENTILATING'S

Ad-Digest SERVICE

A new service for readers of HEATING AND VENTILATING

Below and on the following pages are given brief digests of the advertisements appearing in this month's issue of HEATING AND VENTILATING. Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail the prepaid postcard to request further information from manufacturers.

NOTE: While every attempt is made to list all the advertisements appearing in HEATING AND VENTILATING, we cannot guarantee including those which are received after our published closing date. The Index of advertisers lists all the advertisements in this issue.

TEMPERATURE CONTROL. Page 29. A dual temperature control is the answer to heating to normal occupancy temperature those school rooms which are in use after regular school hours, as in most schools today some areas are in use during late afternoon and evening hours. Advantages of this automatic dual control outlined and illustrated. ..... **Item 201**

AIR CONDITIONING. Page 54. Rustproof finish adds years of life to air conditioning and refrigeration equipment which must withstand brine spray, water, and fumes. Air conditioning equipment is finished in a bonderized two-coat backed chlorinated rubber enamel finish. Process illustrated and described. ..... **Item 202**

AIR DIFFUSERS. Page 19. All diffuser types in a new line are identical in appearance with beautifully styled matching facial contours and the same number of rings, assuring uniformity. ..... **Item 203**

COOLING UNITS. Page 61. Product coolers constructed around rigid angle iron frames with large amount of coil surface, allowing low air velocity. Made in a wide range of sizes. Bulletin available. ..... **Item 204**

COAL. Page 26. How a mid-western university saved $9,000 a year and heated more space by burning coal in a modern manner with no smoke or dust nuisance. ..... **Item 205**

BOILER TUBES. Page 37. The worth of a boiler tube depends on its specifications—uniform wall thickness, diameter and physical properties, freedom from scale and pitting. Time and operating conditions prove that there are differences in boiler tubes over and above the "specs". ..... **Item 206**

PACKAGED BOILER. Page 22. A packaged boiler with all the better design features plus the four following features: fully water cooled furnace; larger lower drum; centrifugal fan; and simple baffle arrangement. Bulletin available. ..... **Item 207**

PROPELLER FANS. Page 33. Propeller type ventilating fans delivering large volumes of air at low resistance and low current consumption, machine balanced, in two types and seven basic sizes. Company also has penthouses for roof installation of these fans. Bulletins available. ..... **Item 208**

Circle numbers corresponding to the advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers. ▶

VALVES. Inside Back Cover. A line of valves, driers and strainers for refrigerating systems including relief valves, wing cap valves, packless valves, ammonia valves, Y-strainers and straight and angle type driers. ..... **Item 209**

STEAM TRAPS. Page 32. A float and thermostatic trap is a most dependable one. Description of trap made of two precision built assemblies. Accuracy of response is the feature of the thermostatic element. Available in a wide range of sizes. Catalog available. ..... **Item 210**

FANS. Page 1. An unusual fan installation where a 14-blade axial-flow pressure fan projects a stream of cooling air on 45-ton steel ladles in a wire factory, cooling them at a far lower cost than was possible previously with compressed air. Catalog available. ..... **Item 211**

V-BELTS. Page 12-13. Engineering and installation expense and time are saved by application engineering and co-ordinated design of this company's motors, controls and V-belts. Six different bulletins are available on motor selection, squirrel-cage motors, motor starters, reduced-voltage starters, guide to V-belts, and variable V-belt drive engineering data. ..... **Item 212**

UNIT HEATERS. Inside Front Cover. A unit heater which provides freedom from collected condensate by pitched U-tubes and an internal cooling leg through which all condensate passes with the result that an inexpensive thermostatic trap can be used with every model. Available in four types for horizontal delivery, a textile model, with a velocity nozzle, and for vertical delivery. ..... **Item 213**

UNIT HEATERS. Page 71. A line of revolving unit heaters which keep workers happy in the summer by giving frequent changes in air motion as well as uniform heating in the winter. Bulletin available. ..... **Item 214**

MOTORS. Page 15. Volume production of dependable and efficient hermetic motors has been a contributing factor in making modern refrigeration equipment economically sound investments. They are available in sizes from 1/8 to 20hp. Bulletin on twin-engineering service is available. ..... **Item 215**

COOLING TOWERS. Page 44. The central cooling of residences opens up a tremendous new market for which this company is prepared with a complete small tower line. Line includes mechanical draft models for 2 to 60 tons, as well as a wide range of sizes and styles of natural draft towers. ..... **Item 216**

AIR CONDITIONING UNITS. Page 24. How this manufacturer mounts and tests the motors at the factory on its unit air conditioners to save set-up time and to assure better operation—this being one example of the special attention going into the units. ..... **Item 217**

PLEASE SEND US MORE INFORMATION.

Circle below item numbers on which you wish further information.

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299	300	301	302	303	304	305	306						

PLEASE PRINT July H-53

Name ..... **Title** .....

Firm .....

Street .....

City ..... **Zone** ..... **State** .....

This card is void after Oct. 1, 1953

HEATING and VENTILATING'S

Ad-Digest SERVICE

PUMPS. Page 58. More than a thousand types and sizes of pumps for industrial uses are available from one manufacturer. ..... **Item 218**

HOT WATER HEATERS. Page 123. How a New England hospital has added to its 22-year old installation of hot water heaters by the installation of two more units of the original make. Catalog available. ..... **Item 219**

EXPANSION JOINTS. Page 57. More large central stations heating plants use this expansion joint than any other type. They are packed by a gun under full steam pressure so that there is no shutdown of steam lines for repacking. ..... **Item 220**

AIR FILTERS. Page 14. Completely automatic self-washing filters in which washing, drying and oiling is controlled electrically on a predetermined time schedule automatically. Water and dirt are automatically flushed to sewer. Built-in controls guard against fire. ..... **Item 221**

INSULATED PIPE. Page 68. A pre-sealed insulated conduit that does not depend on a metal jacket for protection from moisture, leakage and corrosion. Has a patented insulated economical element contact between angle plate and pipe. These and other advantages explained in catalog. Also available is a report on operating service tests. ..... **Item 222**

HEATING PUMPS. Page 127. A line of heating pumps for all types of installations and capacities ranging from 500 to 65,000 sq ft of radiation. Complete information available. ..... **Item 223**

PACKAGED AIR CONDITIONER. Page 143. A dual circuit central station packaged conditioner combining two separate air conditioners, two compressors, two motors, cooling section and evaporative condenser in one unit. Information available. ..... **Item 224**

BLOWERS. Page 56. A full line of blowers for heating or ventilating installations is available for ventilation, forced draft and all types of air moving installations. Catalog available. ..... **Item 225**

INSULATION. Page 5. Accordion type aluminum insulation reduces warehouse transportation and handling bills, has zero permeability to water vapor, prevents condensation, and throws back 97% of heat rays. Booklet and samples available. ..... **Item 226**

CONTROLS. Pages 120-121. How individual temperature control in a 37 building garden apartment development increased rentability and gives the owners a competitive advantage for years to come. Superintendent of the property is quoted as saying the system gave no trouble at all in maintenance. Bulletin available. ..... **Item 227**

BASEBOARD CONVECTOR. Page 152. A new design floor level baseboard convector which solves the wall to wall carpeting problem, keeps walls clean and is simple to install. Literature available. ..... **Item 228**

AIR CONDITIONERS. Page 52. Three styles and five sizes of air conditioners available in capacities from 2 to 10 hp. At slow speed, compressors are self-contained, have five year warranty. Information on request. ..... **Item 229**

PIPE INSULATION. Page 60. How a pipe insulation can be installed, removed and re-applied twenty-five times or more and still be on the job. ..... **Item 230**

AIR FLOW METER. Page 147. An air diffuser manufacturer recommends this air flow meter for measuring the actual air delivery precisely and quickly. Instrument is instantaneous, direct reading, portable, and accurate over a wide range. Bulletin available. ..... **Item 231**

ROOF EXHAUSTERS. Page 137. Power roof exhauster each size actually physically rated to give a true picture of the unit as it operates. Units have built-in-scroll effect which can develop high static pressure up to 4-2/10 inches. Information available. ..... **Item 232**

BASEBOARD HEATERS. Page 2. Statement by the owner of a 1926 house who modernized with baseboard radiators is highly satisfied, likes the beautiful effect of full length drapes with carpeting up to the baseboard, ease of placing furniture, and enjoys comfort from the new baseboard units. Further information available. ..... **Item 233**

VACUUM SYSTEM. Page 31. How a high vacuum heating system perfectly controlled assures maximum fuel economy, comfort and convenience in a hospital, convent, chapel group. System has a 4-zone pneumatic control system. Bulletin available. ..... **Item 234**

YEAR ROUND AIR CONDITIONING. Pages 45-46. A new concept in year round residence air conditioning with central forced water systems. Hot or cold water from central plant is piped to heat exchangers which deliver heated or cooled air from units installed in wall or under floors. Each unit equipped with separate control. Independent for new or old homes, stores, offices, hotels and other buildings. Catalog available. ..... **Item 235**

CONDENSER. Page 144. A remote type air-cooled condenser that eliminates water and sewerage problems and is specifically designed for residential application. Bulletin available. ..... **Item 236**

SNOW MELTING. Page 55. Snow melting systems constitute a multi-million dollar market annually. An attractive and easily understood booklet giving answers to commonly asked questions about snow melting, printed in color, 32 pages, available at no charge ..... **Item 237**

FANS. Page 40. Silent fans and air handling units were chosen for a New York television studio because super-sensitive mikes pick up and magnify every whisper. A line of air handling, air conditioning and air cleaning products featuring quietness, efficiency, and dependability. ..... **Item 238**

FANS. Page 62. How twin fans were used to exhaust the intense heat caused by flame jets and induction heating in a plant manufacturing electron tubes, a process which developed almost three million Btu per hour. ..... **Item 239**

EXPANSION VALVES. Page 49. A line of thermo-expansion valves having only a few moving parts, designed for shell and tube coolers with loads from 75 to 200 tons using F-12. Both pilot and main valves have the company's famous come-apart construction. Bulletin is available. **Item 240**

HEATING COILS. Page 129. Steam distributing tube heating coils for jobs where regulated steam control is needed. Uniform steam distribution is provided through entire coil even when low throttled. ..... **Item 241**

OIL BURNERS. Page 148. Rotary oil burners from 3 to 1000 hp for oil, gas or gas-oil and featuring the engineering service of company's dealers. ..... **Item 242**

UNIT HEATERS. Page 150. A four-way directed unit heater for high ceiling installation in seven sizes and floor units giving directional fan propelled distribution from heights up to 18 ft are among those offered by a company featuring high quality engineering, materials and manufacture. ..... **Item 243**

AIR FILTERS. Page 129. Expanded metal face plate acting as a lint arrestor and air distributor, a feature of a line of filters including low velocity, high velocity and grease filter types. Bulletin available. ..... **Item 244**

PACKAGED AIR CONDITIONERS. Page 59. Quiet operation is a feature of a packaged air conditioning unit due to use of a radial compressor giving perfect balance, flexible connections in refrigerant lines, and rubber mounted compressor. **Item 245**

Postage Will be paid by Addressee

No Postage Stamp Necessary If Mailed in the U. S.

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 53, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

HEATING AND VENTILATING
148 LAFAYETTE STREET
NEW YORK 13, N. Y.

AD-DIGEST SERVICE

Use this Digest to locate and refer to advertisements appearing in this issue of HEATING AND VENTILATING, then fill out and mail the prepaid postcard to request further information.

RADIANT HEATING. Page 23. There is nothing so satisfactory for churches as a radiant panel heating system in a floor slab. Isometric drawing shows layout of actual church installation accompanied by comments of architects, engineers and the church pastor. **Item 246**

CORROSION PROOF DUCTS. Page 145. Standard stock duct sizes in round and square sections in lengths up to 16 ft are available in polyvinyl chloride, corrosion proof to most acids, salts and alkalies. Material also available in pipe and pipe fittings. Bulletin available. **Item 247**

DAMPER HARDWARE. Page 143. Available in a kit, precision engineered brackets and bushings for parallel or opposed action multi-blade dampers. Completely adjustable. Samples available. **Item 248**

STEAM GENERATOR. Page 18. A two-pass design self-contained automatic steam generator. Two pass design eliminates baffles. One feature is that it takes one man less than 30 minutes to open this boiler for cleaning or inspection. Catalog available. **Item 249**

STUD DRIVER. Page 48. How studs can be driven straight into steel or concrete with a powder actuated stud driver which will set up to five studs per minute and weighs only 5½ lb. Bulletin showing how fastening cost can be reduced is available **Item 250**

OIL PREHEATER. Page 131. An integrated self-contained steam vapor generating heat exchanger using gas is the primary heat source for heating fuel oil for any oil-fired apparatus whether it is a hot water boiler or a dryer or a kiln. Cheaper to operate than when using expensive light fuel oils for preheating. Bulletin available. **Item 251**

SHUTTERS AND DAMPERS. Page 152. A complete line of automatic shutters, back draft dampers, ceiling shutters, stationary shutters, hand operated shutters and motorized shutters. Circular available. **Item 252**

TEMPERATURE REGULATORS. Page 142. A performance tested line of temperature regulators for controlling steam heated hot water tanks, vats and preheaters, and featuring the use of specially chosen metals to give positive temperature control and low maintenance cost over the years. **Item 253**

FASTENING TOOL. Page 153. A new model of a powder power fastener which has a break-open action making for fast, easy loading and extraction, a new development in stud drivers which makes fastening to concrete or steel easier than ever. **Item 254**

VENTILATING HOSE. Page 145. How a flexible airtight ducting for moving air gases or materials cuts cost five ways. **Item 255**

AIR INTAKES. Page 149. Prefabricated fresh air intakes containing V-baffles, glass filters, and adjustable closing louvers, and which fit into glass block construction by removing four blocks. **Item 256**

ACIDPROOF PIPE. Page 152. A high silicon iron alloy acidproof drain pipe with high resistance to most commercial acids is installed by same methods as cast iron soil pipe and will usually outlast the building. **Item 257**

Circle numbers corresponding to the advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

VENTILATOR. Page 143. A low contour type roof ventilator for large scale ventilation problems. It is only 32 inches high and built in rectangular units for any type roof. Folder available. **Item 258**

RADIANT HEAT CONTROL. Page 139. Case history of a county home annex with a radiant heating system in thirteen zones, each individually controlled. Important feature of control is an ultra-sensitive heat loss thermostat influenced by both radiation and convection. Catalog available. **Item 259**

CABINET UNITS Page 69. Five attractively styled enclosure designs of cabinets for winter heating and summer cooling. These include one for blanketing doors. Intended for either new construction or modernization. Booklet available. **Item 260**

HOME CONDITIONING. Pages 140-141. Twin units, one for heating, one for air conditioning, so that the former can be sold first and air conditioning added later. Available from a company which announces the most complete line of home conditioning equipment in the industry. **Item 261**

DIFFUSER DATA. Page 35. Useful engineering data on high velocity obtainable in a new manual for air conditioning engineers. **Item 262**

HOT WATER HEATERS. Page 25. Water heaters for space heating, process hot water, general service or even for snow melting are covered in three bulletins available from a heat exchange manufacturer. **Item 263**

PIPE. Page 66. A continuous weld alloy pipe with distinct advantages for radiant heating and snow melting in standard tests has shown four to six times greater resistance to atmospheric corrosion than regular steel pipe. Easy to thread and fabricate. **Item 264**

DIRECT FIRED HEATERS. Page 135. A line of direct fired air heaters in horizontal and inverted models, stoker fired and duct units, ha, separate induced draft fan eliminating cold air blast on starting. Data sheet available. **Item 265**

WELDING NECK FLANGES. Page 21. Forged welding neck flanges, one product in a line of welding fittings by the company which made the first forged steel flanges on a commercial scale and developed formulas for high pressure flanges twenty-six years ago. **Item 266**

REGISTERS. Page 149. All steel registers for walls or ceilings are preferred because of their greater strength, neater appearance, easier maintenance and other features. A register book is available. **Item 267**

PIPE. Page 7. A round-up of radiant heated schools in west Texas which are safeguarded against premature radiant heating failure with wrought iron pipe. Advantages of this pipe include ready forming and welding, high heat emission rate, same expansion rate as concrete and plaster, ample mechanical strength, and corrosion resistance. **Item 268**

FUEL BURNERS. Page 41. A line of burners for gas, oil or dual fuel in 30 to 1,000 hp capacities. The gas and oil burners can be field converted to dual fuel. The dual fuel burners will burn either fuel at the flick of a switch. Factory packaged electronic combustion safeguards. **Item 269**

TEMPERATURE REGULATOR. Page 16. Temperature regulators for steam line guaranteed to shut tight when demand for steam ceases, due to single seat design. **Item 270**

VENTILATING FANS. Page 27. Nothing overcomes objections to bad odors quite as well as removing them. A complete line of ventilating fans including a propeller fan line in capacities from 1000 to 9700 cfm. **Item 271**

VALVES. Page 42. How better quality valves pay off. Case history of a food plant which experienced valve trouble once a week in the cooking room. New valves made little difference since none could stand the steam throttling. Plug type disc valves solved the problem and gave precise control. **Item 272**

ROOF VENTILATORS. Page 131. Rotary ventilators feature lifetime guaranteed bearings and enduring metallic finish on galvanized steel. In sizes 6 inches through 48 inches, have certified capacity ratings. **Item 273**

RADIANT HEATING. Page 51. The key to low cost in ceiling radiant heating is a double-walled tubing with thin, but exceptionally strong walls that transmit heat quickly, has high bursting strength, and saves on material and time costs. **Item 274**

PLEASE SEND US MORE INFORMATION.

Circle below item numbers on which you wish further information.

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PLEASE PRINT July H-53

Name ..... **Title** .....

Firm .....

Street .....

City ..... **Zone** ..... **State** .....

This card is void after Oct. 1, 1953

HEATING and VENTILATING'S

Ad-Digest SERVICE

DRAFT CONTROLS. Page 146. Draft controls for commercial gas-fired heating plants are now available to give accurate fuel saving performance. ..... **Item 275**

PACKAGED BOILERS. Page 53. Infinitely variable combustion modulation is obtained with the gas burners with this boiler so that there is no fuel waste. Other features include immediate changeover to alternate fuels. Bulletin available. **Item 276**

VALVES. Page 135. A line of precise control bronze globe valves gives needle valve control and durability of stainless steel. Features include stainless steel disc and seat and two-piece union bonnet. **Item 277**

HUMIDITY CONTROL. Page 137. A new method of drying air precisely as wanted by contact with a liquid in a small spray chamber. Contact temperature and absorbent concentration, easily and positively controlled, determine exactly amount of moisture in leaving air. ..... **Item 278**

AIR-WASHER PIPING. Page 11. One of a series of practical piping layouts showing in detail how to plan piping for an air washer air conditioning system. Detail shown is a two-stage installation for cooling, dehumidifying, and cleaning air for comfort. Enlarged diagram is available. ..... **Item 279**

WASHABLE AIR FILTERS. Page 39. A washable air filter, selling from $1.55 up for forced air furnaces and air conditioners, builds profits for dealers. **Item 280**

STEEL BOILERS. Page 122. The president of a corporation owning apartments has installed this steel boiler in its seventh apartment and has found them efficient, economical, and easy to maintain and trouble free. Bulletin on apartment type boilers available. ..... **Item 281**

STEAM TRAPS. Page 147. Equipment temperatures were 30 to 40 degrees higher after mechanical traps had been replaced in a plant. There was also faster warm-up, no air-binding and a fuel saving of 10%. Bulletin is available. ..... **Item 282**

BLOWERS. Page 147. The most diversified selection of packaged centrifugal fans available. ..... **Item 283**

RADIANT HEATING. Page 38. Advantages of radiant heating by forced hot water outlined and a case history illustrated. ..... **Item 284**

SPRAY NOZZLES. Page 133. A line of spray nozzles in two different types, involute for producing a fine hollow cone spray with minimum energy loss, and fan spray for flat fan shaped spray with time saving slicing action for cleaning. Bulletin available ..... **Item 285**

FIRE EXTINGUISHER CABINETS. Page 145. Recessed or outside wall types in 36 models and 4 sizes wear better, look better, and discourage tampering. ..... **Item 286**

BOILERS. Page 151. A line of compact steel heating boilers made by automatic welding with ample combustion area, positive circulation full width flue doors, and other features. Bulletin available. **Item 287**

COPPER TUBE. Page 30. Copper tube and solder joint fittings which withstand 3400 pounds pull and 5000 pounds per square inch water pressure. Advantages of flared connections for all piping jobs from drainage lines to radiant heating. ..... **Item 288**

WELDING FITTINGS. Page 43. Distributors for a welding fittings line assume responsibility of dealing with many manufacturers' salesmen and expediting and following through your orders, thus saving purchasing man-hours. ..... **Item 289**

HOUSE COOLING. Page 70. A packaged liquid chiller system installed in conjunction with radiator heating and which circulates chilled water in summer and hot water in winter. Plant fits snugly into a hall closet as shown in a Dallas home which won a prize from local architects. ..... **Item 290**

BLOWERS. Page 20. The most diversified line of packaged centrifugal fans, available in direct drive and belt drive, forwardly-curved slow speed or backwardly-inclined non-overloading models. 103 different models to choose from. .... **Item 291**

PIPE FITTINGS. Page 139. A line of cast iron and malleable pipe fittings in 3,000 shapes and sizes of high tensile strength, free from thin walls and sand holes, and with full clean threads. ..... **Item 292**

HEAVY OIL BURNERS. Page 133. By burning thrifty heavy fuel oils, building owners can save up to 30 per cent on fuel costs. An oil burner for No. 5 oil in sizes from 1 to 60 gph capacity. ..... **Item 293**

DUST CONTROL. Page 50. Big air pollution problems come from little dust sources. Over 20,000 of one make of dust control units are helping industry forestall court injunctions and citizens committees by removing dust. ..... **Item 294**

FANS. Page 17. A comprehensive line of centrifugal and axial flow fans for every purpose. Advertisement illustrates and briefly describes fourteen of these. ..... **Item 295**

BOILERS. Page 28. Available in two types and twenty-five sizes, a quality built line of gas boilers is described. It can be used in batteries in larger buildings to provide a flexible heat source. Features include pintype sections, automatic gas valve, automatic pilot, and efficient burners. Sub-assembled, easy to insall. ..... **Item 296**

RESIDENTIAL COOLING TOWERS. Page 36. A line of residential cooling towers from 2 to 15 ton capacities offers as an exclusive feature a 20-year guarantee on its wetted deck surface. It priced for the home market which has become large because cooling towers are now required in many areas. ..... **Item 297**

AIR RECOVERY. Page 67. By taking odors and gaseous impurities out of used air, air recovery equipment manufactures fresh air so that less outside air which has to be heated or cooled need be brought in. 10,000 installations back up the company's claims. ..... **Item 298**

COPPER TUBING. Page 47. A Boston housing project of 274 units has installed copper tubing exclusively. The contractor who has purchased over a hundred miles of this tubing in the past five years prefers it because of its uniform wall thickness and ease of bending. ..... **Item 299**

DUAL FUEL BURNER. Page 149. A burner engineered to insure peak efficiency with either gas or oil and which has a long list of features including optional automatic or manual changeover, is available in a wide range of sizes. ..... **Item 300**

RADIATOR TRAPS. Page 131. Since he has 1281 radiator traps in his hotel in Montana for use in over ten years and replaced only half a dozen elements, the chief engineer has reordered these traps for 63 new rooms. ..... **Item 301**

UNIT AIR CONDITIONERS. Page 127. A line of unit air conditioners are available in 3, 5, and 7½ H.P. sizes, which deliver more cooling effect per dollar. ..... **Item 302**

DRAFT INDUCER. Page 71. Motorized chimney draft overcomes weather variable and variable load assuring positive uniform draft. Intended for oil, gas, stoker-fired or hand-fired heating boilers. Bulletin available. ..... **Item 303**

AIR CONDITIONING. Page 125. This company makes wide range of air conditioning equipment, does not have to compromise in recommending any one of a few systems for a given job but can recommend with broad impartiality installation that precisely suits the building that you are air conditioning. ..... **Item 304**

LOW WATER CUT-OFFS. Back Cover. A discussion of the use of low water cut-offs on hot water boilers. This rather unorthodox procedure is justified because a pressure reducing valve feeds makeup water only under normal conditions. When an emergency develops and the boiler pressure is higher than the reducing valve setting, there is no longer any makeup and something is needed to stop the firing and save the boiler. A bulletin on this ever-broadening field is available. **Item 305**

TEMPERATURE CONTROL. Pages 64-65. Typical examples of prominent secondary public schools equipped with pneumatic temperature control system. System includes air stream thermostat for unit ventilators and room thermostats noted for years of dependable operation without repairs. ..... **Item 306**

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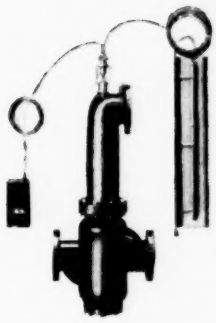
AD-DIGEST SERVICE

York County Home Annex, York, Pa. Architect: Clair S. Buchart, York, Pa. Engineer: William K. Hood, York, Pa. Heating Contractor: C. C. Kottcamp & Son, York, Pa. Floor type Radiant Heating System divided into 13 zones, each controlled by type STA-1 Sarcotherm controls and "Thermoray" comfort thermostats.

ENGINEER-MANUFACTURER
CO-OPERATION
results in perfect comfort
WITH
Sarcotherm
RADIANT HEAT CONTROL



• The heart of the Sarcotherm control system for radiant or forced hot water heating is this unique control valve. It is actuated by liquid expansion thermostats, one located outside the building and one in the valve itself. Between them they anticipate changes in heat loss ratio, thus maintaining comfort temperatures under all conditions.

Here is a striking example of the advantages of close cooperation between the architect's designing engineer and an equipment manufacturer who not only offers complete weather compensated control systems for hot water and radiant heating, but can supplement this with 30 years' experience and the most complete line of accessories for all types of heating.

In the case of York County Home Annex illustrated, engineer William K. Hood, York, Pa., designed a radiant heating system divided into 13 zones, each individually controlled by Sarcotherm.

An important feature of the control system is the unique "Thermoray," a very sensitive heat loss thermostat, influenced by both radiation and convection.

Sarcotherm also regulates supplementary baseboard heating, and unit heaters.

Send us your next problem—there is no obligation. Or write for complete catalogue.

22-A

• The Sarcotherm Comfort Control "Thermoray" is an extremely sensitive thermostat affected by both radiation and convection.

Sarcotherm CONTROLS, INC.
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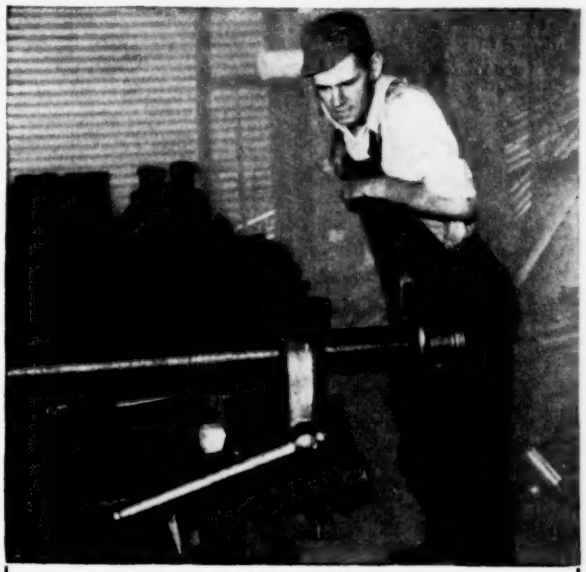
A SARCO PRODUCT



Even though the work bench grunts!

You can be sure that "K" Fittings have the stamina to stand all the strain put on them in making up tight joints. Our metallurgists control cupola mixes to maintain tensile strength above 30,000 lbs. while the standard is 21,000 lbs.

What's more, "K" Fittings are sound and uniform. Skillful molding assures freedom from thin walls, cold cheeks, sand holes. Threads of screwed fittings are tapped full and clean. Openings are chamfered so pipe will enter easily. The faces of flanged fittings are accurately milled; bolt holes exactly spaced.

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Standard and Extra Heavy Screwed Steam Fittings.
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The "K" on a fitting is our guarantee—your safeguard.

Good workmanship sells "K" Fittings

K PIPE FITTINGS
CAST IRON AND MALLEABLE
3,000 Shapes and Sizes

Complete information gladly furnished.

THE KUHNS BROTHERS COMPANY
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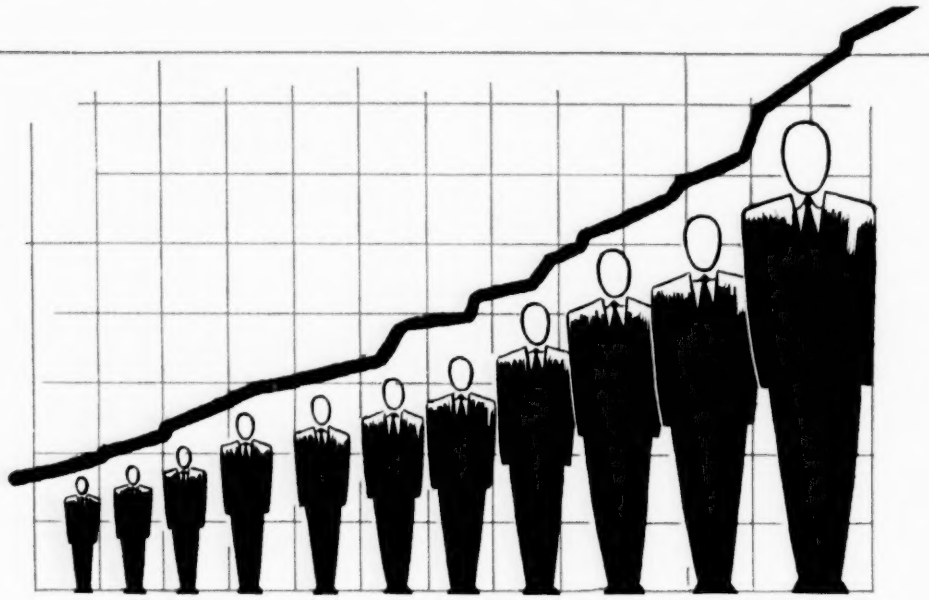
Established 1887
Combined marketing facilities with Malleable Iron Fittings Company, Branford, Conn.

with more and more homeowners turning to **YEAR 'ROUND CONDITIONING...**



Authoritative forecasts indicate home air conditioning will grow to a 5-billion-dollar business by 1958!

You can double your profit with bryant

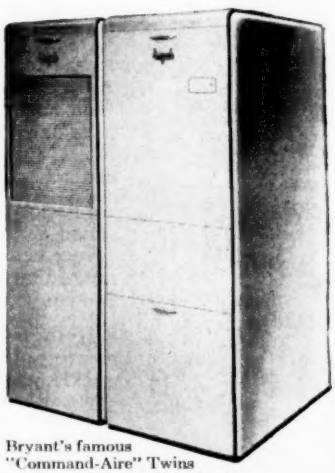
Take your choice!

First—in Bryant's "Command-Aire" Twins you can sell, at one time, both heating and cooling . . . realizing an immediate double or even greater profit. And, the surprisingly low unit price promises large volume sales—a plus factor for even greater profits. Or . . .

Second—you can sell heating first—air conditioning later! With the "Command-Aire" Twins, you have the opportunity to sell the furnace first (either gas or oil) and then arrange to add the air-conditioning twin at the convenience of the buyer. No matter how you figure it you're in the ideal position to conclude a highly profitable double sale.

And Bryant helps you sell! To strongly supplement Bryant's extensive national advertising program, Bryant heating and air-conditioning literature will be sent to over 80,000 families definitely known to be building new homes within the next 12 months. Names of these families, in your area, will be supplied to you—another reason to investigate this handsome 2-way profit opportunity, today.

Contact your nearby Bryant distributor for complete information, or simply write: Bryant Heater Division, 17825 St. Clair Avenue, Cleveland 10, Ohio.



Bryant's famous "Command-Aire" Twins year 'round air-conditioning team.

THE MOST COMPLETE LINE OF HOME CONDITIONING EQUIPMENT IN THE INDUSTRY

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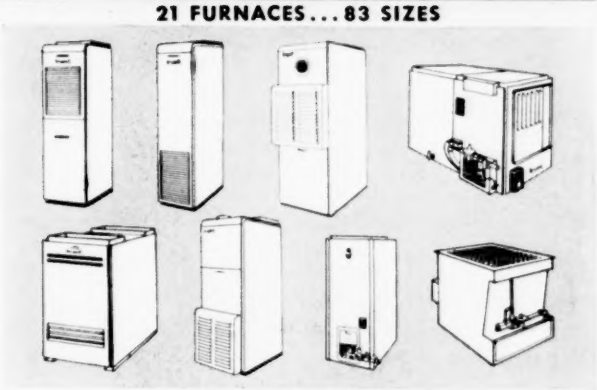

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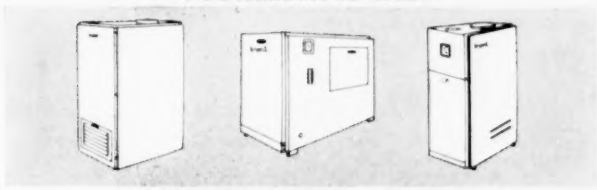

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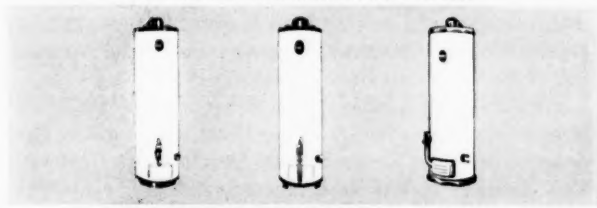

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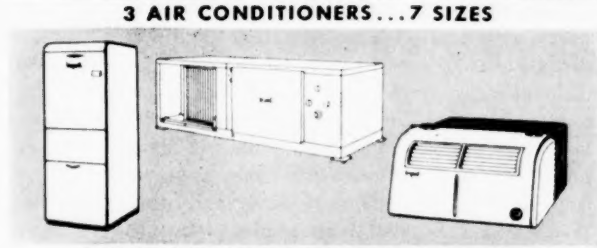

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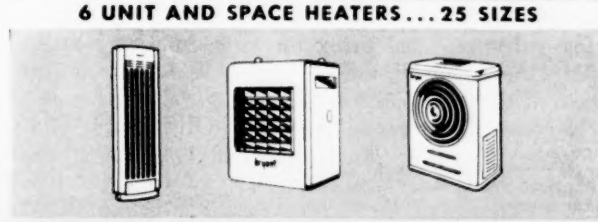


bryant®

HEATING • AIR CONDITIONING | WATER HEATING

NEW YORK AIR

(*Continued from page* 138)

rounding houses may be bombarded with flyash and smudge.

Where necessary, the management of these buildings is summoned to the department offices, Dr. Greenburg said, and asked to produce an engineering solution to the problem or face a ban on operation. He added that he would like to see all the incinerators shut down completely, and have garbage handled through the Department of Sanitation. The addition of this 400,000 tons of refuse, however, would impose an additional burden of 9 per cent on the latter department, and the plan would not be affordable in the present state of city finances.

• **DEPARTMENT.**—Dr. Greenburg's department, formerly limited to smoke but now expanded to act against installations, causing excessive dust, fumes, gases, chemical pollution, automotive exhaust or odors, recently was granted additional funds so that a modest laboratory will be set up. This will permit sampling analysis and the setting up of standards. The most serious lack now, Dr. Greenburg commented, is the absence of a meteorologist on the staff.

Asked as to what could be done about pollution contributed to city skies by New Jersey chimneys, Dr. Greenburg said that a couple of years ago a joint committee to study the situation was named, and New York appropriated $30,000, but when New Jersey failed to make a matching appropriation the work could not go ahead. With the laboratory which now has been made possible, the commissioner said, it may be possible to take samples in the Staten Island area to estimate how much pollution is coming in from New Jersey. It is for investigations of this sort, he said, involving the spreading of pollution from one large area to another, that the services of a meteorologist are important.

WATER VISCOSITY

has new value adopted by National Bureau of Standards. Meters and tables will have to be revised.

The National Bureau of Standards will adopt a new value for the viscosity of water on July 1, 1953. As a result of the research conducted by Messrs. J. F. Swindells, J. R. Coe, Jr., and T. B. Godrey, a new value of 1.0038 centistokes at 68F has been established in place of 1.0070 centistokes at 68F, the value currently in use.

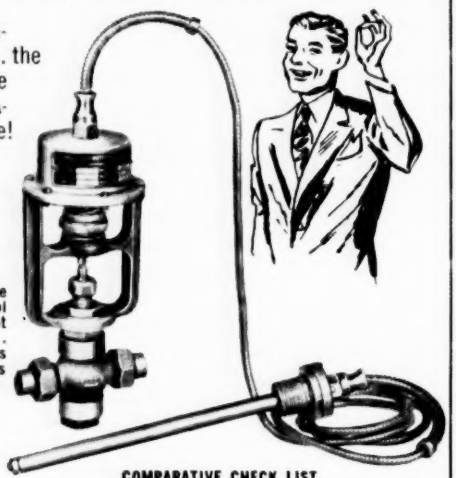
Accordingly, extensive revisions to viscosity tables will be required. The ASTM Committee D-2 on Petroleum Products and Lubricants is currently preparing the necessary revisions to the viscosity standards and tentatives affected.

The National Bureau of Standards initially proposed to adopt this new kinematic viscosity value on July 1, 1952, but, at the request of Committee D-2, granted a full year's delay in order to give proper publicity to the project and to give those concerned an opportunity to study the subject. Method D445-52T will be revised to cover the new adopted value on July 1, 1953.

NOW and ten years from NOW

. . . contented customers will confirm YOUR reputation!

Lawler's "Performance-Tested" design combines pioneering experience with engineering leadership. The use of specially chosen metals assures YOUR customers years of positive accurate temperature control with lowest maintenance cost . . . the best insurance YOUR REPUTATION can have!



TYPE "S" Temperature Regulators

For accurate temperature control of steam heated hot water tanks . . . vats . . . preheaters . . . process tanks

Compare!

List the facts . . . Check them off . . . Lawler comes out first every time! YOUR REPUTATION is protected!

COMPARATIVE CHECK LIST

LAWLER TYPE "S" TEMPERATURE REGULATOR	Product "A"	Product "B"
Delivery ✓		✓
Special Purpose ✓		
Hydraulically Formed Bellows ✓	✓	
Smaller Spread—More Accurate Control ✓		

The Lawler Line Thermostatic Controls

"Performance-Tested" for Longer Life

STEAM TEMPERATURE REGULATORS · SHOWER MIXING VALVES · WATER CONTROLLERS · TEMPERING VALVES

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453 North MacQuesten Parkway Mount Vernon, New York

Changes in viscosity measurements will be affected and changes in standards will be necessary. All kinematic viscosity measurements, for example, will be reduced by 0.318%. Saybolt Universal and Furol viscosities, however, will not be affected. This means that viscosity conversion tables will require revision. The new tables will be available from ASTM headquarters after June 1, 1953.

All kinematic viscometers in use will require restandardization or recalibration. Kinematic viscometers which have C-constants that are not simple numbers (i.e., 0.1, 0.3, 0.5, etc.) may be restandardized or recalibrated merely by multiplying their present factors by 0.99632 (or $\frac{1.0038}{1.0070}$). However, a more complicated procedure will be required where the C-constants are simple numbers, since the physical dimensions control the value of C and any one or all of the dimensions may have to be adjusted, if it is desired to retain the simple number C-constant.

SYNTHESIS GAS

produced directly from pulverized coal in process developed by B&W. Full scale plant to be built.

A new process whereby pulverized coal is converted in one step to synthesis gas, a mixture of carbon monoxide and hydrogen which is the base of over 100 of the world's most important chemicals, was explained before a meeting of the American Gas Association in New York.

Speaking before the Production and Chemical Conference of the association at the Hotel New Yorker, Paul Grossman of the Research and Development Center of The Babcock & Wilcox Company, Alliance, Ohio said that the new process produced synthesis gas directly from pulverized coal in one operation, while the previous method was to convert the coal to coke and then in additional steps, convert the coke to synthesis gas. He also pointed out that the new process would produce the gas much more economically than the old method by permitting the use of lower grade coals, and would also lend itself to operation in widely diversified locations instead of only near beds of high grade coal.

• **PILOT.**—The company's 30 years experience in utilizing pulverized coal firing for large industrial boilers, Mr. Grossman said, was an important factor in the success of this development. The first pilot plant for using the new gasifying process was built by Babcock & Wilcox for the Bureau of Mines and went into operation at Morgantown, W. Va. in the summer of 1951. It burned about 500 pounds of coal per hour and produced 330,000 cubic feet of carbon monoxide and hydrogen gas per day, he said.

A larger size, semi-scale plant was built next for the Du Pont Company and was placed in operation at their Belle, W. Va. works in the fall of 1951. This plant converted 3000 pounds of coal per hour into gas, producing over 2,000,000 cubic feet per day. As a result of these

(*Continued on page* 144)

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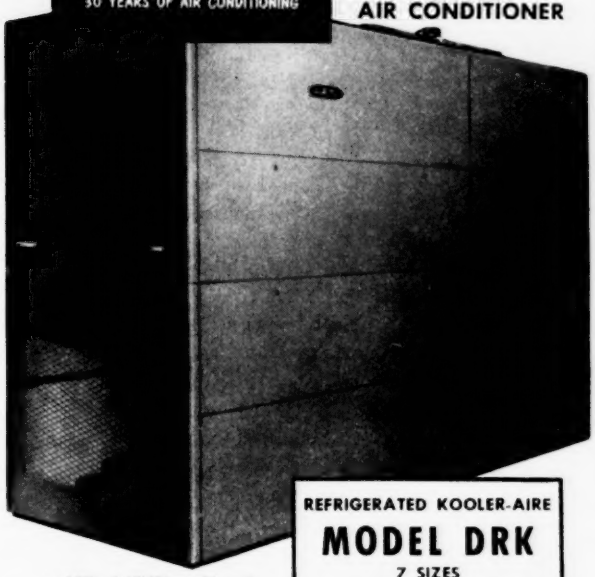
30 YEARS OF AIR CONDITIONING

DUAL CIRCUIT
CENTRAL STATION
PACKAGED
AIR CONDITIONER



REFRIGERATED KOOLER-AIRE
MODEL DRK
7 SIZES
10 to 50 H.P.

usAIRco's DRK combines 2 separate refrigeration circuits two compressors, two motors, cooling section and evaporative condenser in one central station. One or both compressors operate automatically depending upon load requirements. Separate refrigeration circuits permit continued dehumidification when operating at reduced capacity.

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UNITED STATES AIR CONDITIONING CORPORATION
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Engineers • Manufacturers & Fabricators

FOR MULTI-BLADE DAMPERS
(Parallel or Opposed Action)

Specify and use the . . .

"DURO BLADE KIT"

PRECISION-ENGINEERED DAMPER HARDWARE

- Produces highest quality damper
- Blade openings individually adjustable. Automatic, self-centering DURO-BRACKET assures smooth, non-binding, quiet operation. Self-oiling DURO-BUSHINGS "tap-fit" into frame.
- Complete adjustability, even after installation, cuts time and cost. Allows use of unskilled labor.
- Sturdy, corrosion resistant materials used throughout. Can be used on heaviest dampers.

For Samples—Prices write Dept. E

DURO-DYNE
CORPORATION
38 South Franklin Street,
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Solve toughest large scale ventilation problems

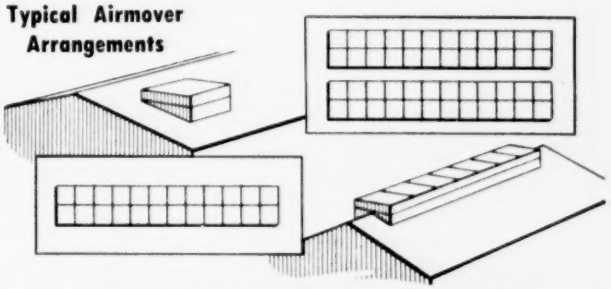
The low-contour **Airmover** for high-capacity air movement

You can have all the ventilation you want—at economical cost. Airmover exhausts large quantities of heat, smoke or fumes rapidly through its short-air-travel, low-air-friction construction. It's only 32 inches high, built in rectangular units that can be placed on any type roof.

Install any number of units in continuous runs. You literally can "open your roof to the sky", yet have full weather protection. Single units or shorter runs prove effective over specific "hot spots". The low contour and unusual flexibility have made Airmover the popular industrial ventilator. Write for Folder 326H.

The Swartwout Line includes a variety of gravity and powered ventilators.

Typical Airmover Arrangements



18511 Euclid Avenue, Cleveland 12, Ohio
The Swartwout Co.
Roof Ventilators and Ventilating Louvers
POWER PLANT EQUIPMENT • PROCESS INDUSTRY CONTROLS

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AIR
CONDITIONING
Without Water!

UNICON
by KRAMER

A Remote Type Air-Cooled Condenser that completely eliminates water, sewerage and plumbing problems.

SPECIFICALLY DESIGNED FOR RESIDENTIAL APPLICATION

Unusually Quiet!

WRITE FOR BULLETIN No. U 250

KRAMER TRENTON CO.
Trenton 5, N.J.

SYNTHESIS GAS

(*Continued from page* 142)

early experiences, Mr. Grossman revealed that Du Pont has placed an order for a full scale plant with B&W which is scheduled to go into operation some time next year. Mr. Grossman said that he could not reveal the exact capacity of the new Du Pont plant, but that it would be the largest single unit in the world for producing synthesis gas by either the old or the new method. He showed drawings of a typical full scale plant which converted 17 tons of coal per hour into synthesis gas and would produce about 25,000,000 cubic feet of this gas per day. The gas from this plant would be sufficient to supply the fuel needs of about 3,000 average homes.

• **PROCESS.**—To produce synthesis gas by this method, Mr. Grossman explained, pulverized coal, oxygen and superheated steam are sprayed through a burner nozzle into a refractory lined furnace. The molten slag and ash from the burning coal and oxygen drop to the bottom of the furnace and the gases rise and are drawn off for further processing into chemicals. The plant also utilizes the heat to produce steam for other purposes.

FUEL SAVINGS

by armed forces modernization program amount to millions—with techniques worked out by industry.

Keeping the combined populations of Boston, Philadelphia and Los Angeles warm in a room the size of the state of Pennsylvania is a big job— and one that is seldom publicized by the Defense Department.

But according to a report released recently, the Pentagon can rightfully claim recognition as the nation's number one stoker. It must keep warm 4,837,168 civilian and military employees on bases and installations covering over 43,000 square miles of real estate.

• **SAVING FUEL.**—In spite of this sprawling task, Army, Navy and Air Force offices in Washington charged with this problem have successfully instituted fuel conservation programs since World War II that have saved the taxpayers millions of dollars in recent years.

With the Navy claiming a savings of almost $10 million during the last calendar year and the Army reporting an annual savings of $1.4 million, their programs are right in step with Defense Secretary Wilson's current economy drive to cut costs.

Industry has had its hand in this campaign, too. One firm, Minneapolis-Honeywell Regulator Company, conducted surveys at its own expense in almost 100 Army, Navy and Air Force bases to evaluate heating and air conditioning facilities for economy, safety and better living conditions. Because of these surveys, modernization programs at many bases have resulted in the saving of tax dollars.

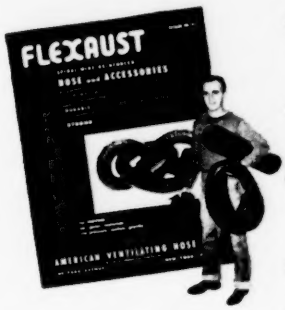
• **ARMY.**—In recognition of the assistance from industry, a report from the Army states, "Control manufacturers have rendered valuable assistance to the Office,

(*Continued on page* 146)

FLEXAUST* HOSE CUTS COST 5 WAYS

Highly Flexible Airtight Ducting
. . . For Moving Air, Gases, Materials
Via Pressure, Suction, Gravity

NEW CATALOG No. 35 SHOWS HOW FLEXAUST HOSE:



- **Saves labor** because Flexaust hose bends sharply without kinking or flattening, is easy to install.
- **Assures long life** with its excellent resistance to moisture, acids, abrasion.
- **Gives trouble-free service** because of its spiral-wire reinforced, double-ply construction and Neoprene coating.
- **Has many applications** in virtually every industry.
- **Custom-made accessories** are produced for unusual or special applications.

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Sizes: 1¼" ID to 28" ID
Varied types, coatings and fittings

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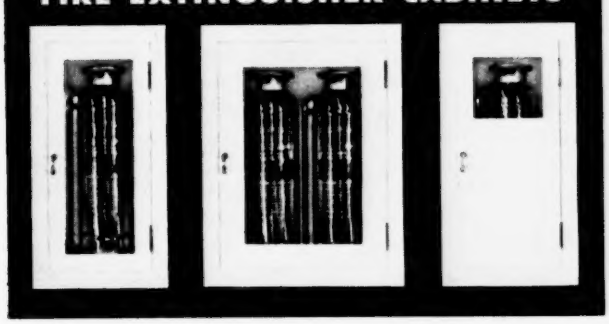
for Appearance, *for* Lower Maintenance,
for Emergency Reliability

ALLENCO

FIRE EXTINGUISHER CABINETS

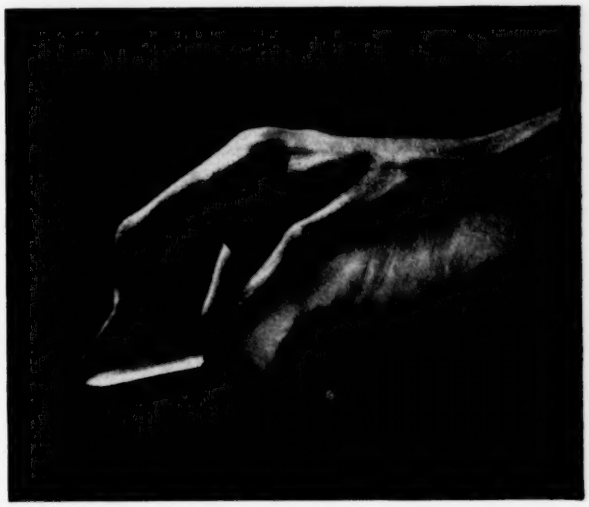


Recessed or Outside Wall Types — 36 Models — 4 Sizes

Cabinet-enclosed extinguishers look better, wear better, discourage tampering and personal injury. And you'll find the best in ALLENCO —voted *first* in interior fire protection by architects, engineers, distributors and contractors.

See SWEET'S . . . write for nearest consulting office and A. I. A. file 29e2

Established 1887
W. D. ALLEN *Manufacturing Co.*
CHICAGO 6 • NEW YORK 7



A scratch that could be costly . . . but isn't

Scratch or damage the surface of most "corrosion-proof" fume ducts . . . and you expose a non-resistant structural material. Corrosion gets its start. This is not true, however, where you use ATLAS AMPCOFLEX®.

AMPCOFLEX is an unplasticized, rigid polyvinyl chloride. It is corrosion-proof . . . and a self-supporting structural material in itself. If scratched, only more AMPCOFLEX is exposed . . . it is corrosion-proof throughout. Neither normal wear nor corrosive fumes and splash can necessitate the costly maintenance common to other type constructions. AMPCOFLEX resists most acids, salts, alkalies and standard pickling and plating solutions.

Aside from the advantages of AMPCOFLEX as a material . . . ATLAS fabrication is an important consideration. Backed by over thirty years experience in corrosion-proof materials and constructions, ATLAS has set up special shops and personnel exclusively for AMPCOFLEX Fabrications. ATLAS can assist you in design and engineering; and furnish any type, any size structure capable of withstanding both chemical and physical abuse. In addition, ATLAS can furnish pipe, pipe fittings and the necessary accessories.

***STANDARD STOCK DUCT SIZES AVAILABLE** in both round and square sections in lengths up to 16 feet. Write for information.*

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FABRICATIONS

greater efficiency for

Commercial and Industrial

GAS

fired heating plants with

field

"M-G" draft controls

1. Double acting gate opens inward to regulate up-drafts and outward to relieve down-drafts.
2. Adding or taking off weights provide simple adjustment for up-draft conditions at time of installation.
3. Control will relieve internal or down-draft pressures of only a few thousandths of an inch.
4. Weights attached to gate itself are factory set to insure extreme sensitivity to down-draft conditions.
5. Corrosion resistant knife edge bearings resting on self-aligning bearing plates assure extreme sensitivity yet long life.
6. Side wings improve the regulation, making the control accurate at all gate positions.
7. Long collar keeps gate out of the path of flue gases—resulting in greatly increased life.

Now there is a Field Draft Control to provide for commercial gas-fired heating plants the same accurate, dependable, fuel-saving performance that has made Field first choice for oil and coal furnaces. The new Field "M-G" for gas is fully proven, widely accepted, fully safe — a control specially designed for gas but retaining all outstanding design features of the Field Type M Control. Write today for complete information.

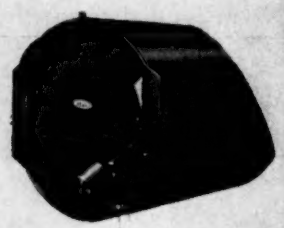
FIELD CONTROL DIVISION

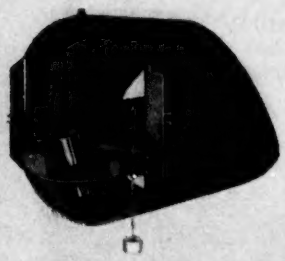
of H. D. Conkey & Company — Mendota, Illinois

AFFILIATES: Conco Building Products, Inc.—Brick, Tile, Stone
Conco Materials Handling Division—Cranes, Hoists

UP-DRAFT VIEW

Gate opens inward to regulate updrafts in conventional, proven manner, checking any excess in draft.





DOWN-DRAFT VIEW

Gate opens outward to relieve down drafts which might affect flame. An optional safety switch closes main gas valve in case of prolonged down draft, thus providing full protection.

FUEL SAVINGS

(*Continued from page* 144)

Chief of Engineers, the major Army commands, and to the post engineers at individual installations through consultations, surveys, and preparation of training media. In one Army area the fuel conservation program, including the use of automatic control systems, has resulted in savings of approximately 15% of its fuel costs for fiscal year 1952."

This business-minded approach to the problem of eliminating waste and inefficiency in heating the hundreds of military bases throughout the country is reflected by a sign prominently displayed by the Army Engineers, "Less fool conversation; more fuel conservation."

Steadily decreasing fuel consumption in terms of the individual soldier during the last few years is evidence of the program's effectiveness. In 1952 it cost about $32 to keep each GI warm compared with approximately $52 in 1948. Attributing much of this reduction to its fuel conservation program, the Army estimates that during the past year savings were about 5% of its annual fuel bill.

The Kansas Ordnance Plant, Parsons, Kansas, represents an outstanding example of how modernization and conservation have saved one Army base an estimated $100,000 per year, or almost $20 per man. At this ordnance plant a complete modernization of the heating facilities was undertaken in 1951 including the installation of automatic controls governing the amount of heat used in relation to the air temperature.

• **NAVY.**—The Bureau of Yards and Docks, responsible for keeping the Navy's "landlubbers" warm and dry on shore bases, keeps a close watch on operating costs, too. Economy studies and the Bureau's efforts toward maximum economy have resulted in an estimated $10 million savings by the Navy in the past year.

A Navy spokesman explains that contributing factors to this success story have included "the use of automatic controls, improved boiler cleanliness through proper feedwater treatment, use of the most economical and efficient fuels and heating equipment, as well as air conditioning where a marked improvement in productiveness and efficiency of personnel will be realized."

The Navy also disclosed that its permanent shore establishments are designed to operate on more than one type of fuel. A lesson from World War II, this assures continued operation in the event of emergencies arising from strikes, sabotage, breaks in gas lines, or the menace of submarines to oil-bearing tankers.

• **AIR FORCE.**—Regulations for the fuel conservation program of the Air Force even spell out when to open and close windows, and the maximum temperature permitted for barracks, repair shops, offices, classrooms, hangars, and other working areas found on air bases. Hot water can be heated only to 180 degrees . . . and then for only certain specified purposes!

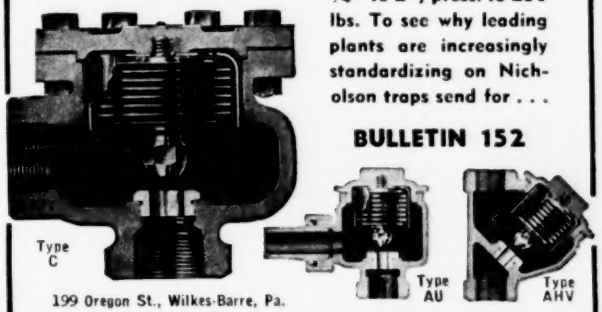
• White-Rodgers Electric Co., St. Louis, maker of automatic controls, has announced the appointment of R. A. Sherer as sales manager with headquarters in St. Louis.

Nicholson Steam Traps

STOP AIR BINDING, Raise temperature 35°

Equipment temperatures were up 30° to 40° higher after Nicholsons replaced mechanical traps in his plant, according to Chief Engineer H.F.D. He also reports faster warm-up, stating that all air-binding was relieved. And "saving in steam waste cut our fuel cost at least 10%". 5 types for process, heat, power. Sizes, ¼" to 2"; press. to 250 lbs. To see why leading plants are increasingly standardizing on Nicholson traps send for . . .

BULLETIN 152



199 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

Kno-Draft recommends *Alnor* VELOMETER for Precision Air Flow Readings

Ask The W. B. Connor Engineering Corporation how to balance an installation equipped with their Kno-Draft diffusers, and they'll tell you . . . measure the *actual* air delivery—precisely and quickly—with an Alnor Velometer.

Balancing a Kno-Draft equipped installation is a fast and accurate process when using an Alnor Velometer. A few simple readings of the instrument and a twist of the wrist are all that is required to adjust the air flow to the desired amount.

The Velometer is the *only* instantaneous, direct-reading air velocity meter—accurate in all ranges, from high to low—compact, portable, easy to understand and use. Wide assortment of jets and fittings makes this precision instrument ideally suited for all air velocity measurement.

For your air measurement needs, get an Alnor Velometer. You'll save time and money wasted in balancing air distribution on your next installation. If you'd like a copy of the instructions on balancing Kno-Draft diffusers with the Alnor Velometer, just send the coupon below.

Illinois Testing Laboratories
Room 514, 420 N. LaSalle St.
Chicago 10, Ill.

☐ Send Kno-Draft Balancing Instructions
☐ Send Velometer Bulletin 2448-G

Name.....

Company.....

Address.....

City.....Zone.....State.....

Alnor PRECISION INSTRUMENTS FOR EVERY INDUSTRY

The Herman Nelson line of UNIT BLOWERS *offers industry the most diversified selection of packaged centrifugal fans available.*

For a "BLOW-BY-BLOWER" description write to . . .

American Air Filter COMPANY, INC
Louisville 8, Kentucky

Original installation or extension of existing heating plants—

Ray Service is always handy!

Wherever you are, whatever type of burner your specifications call for... a capable Ray Franchised Dealer is at your service to help you plan and to complete your burner installation.

Ray dealers are part of a team which has been growing in size and efficiency for 81 years. Modern facilities and techniques combine with experience to provide the best oil burner service you can buy. That is why today *"Every third rotary oil burner in service is a Ray"*.

Contact the Ray Dealer nearest you and take advantage of this complete engineering and installation service.

***Rely on your Ray Dealer*—you'll find his name in the yellow pages of your telephone directory.**

There is a Ray Burner for every purpose from 3 to 1,000 H. P. firing oil, gas, or gas-oil combination.

RAY OIL BURNER CO.

Since 1872

1301 San Jose Avenue • San Francisco 12, California
Atlantic Seaboard Div. • 629 Grove St., Jersey City 2, N. J.

Canadian Degree-Days for May, 1953*

City	May		Cumulative	
	1953	Normal	1952-53	Normal
Calgary, Alta.	540	480	8738	9111
Charlottetown, P.E.I.	595	536	7595	8263
Crescent Valley, B. C.	403	403	6758	7731
Edmonton, Alta.	405	428	9244	9797
Fort William, Ont.	558	567	9503	10045
Grande Prairie, Alta.	403	505	10039	10122
Halifax, N. S.	513	493	6558	7395
London, Ont.	321	307	6854	7275
Medicine Hat, Alta.	397	301	7955	8495
Moncton, N. B.	522	474	7929	8568
Montreal, P. Q.	245	325	7321	8413
North Bay, Ont.	365	434	8748	9180
Ottawa, Ont.	268	310	7657	8674
Penticton, B. C.	285	273	5600	6346
Porquis Junction, Ont.	555	558	10339	11144
Prince George, B. C.	437	490	8636	8996
Quebec City, P. Q.	333	428	8078	9276
Regina, Sask.	502	434	10038	10891
St. John, N. B.	477	505	7145	8081
Saskatoon, Sask.	483	397	10205	10478
Toronto, Ont.	277	341	6214	7236
Vancouver, B. C.	304	326	4869	5303
Victoria, B. C.	387	366	4840	4935
Windsor, Ont.	234	251	6137	6705
Winnipeg, Man.	427	397	9836	10841

*These data are supplied through the courtesy of the Meteorological Division, Air Service Branch, Department of Transport, Canada.

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

INSTRUMENT EXHIBIT—8th National Instrument Conference and Exhibit of the Instrument Society of America, at the Sherman Hotel, Chicago, Ill. John McCaffery, assistant executive secretary of the Society, 1319 Allegheny Ave., Pittsburgh 33, Pa. . . . . **SEPTEMBER 21-25, 1953.**

CORROSION ENGINEERS MEETING—Meeting of the South Central Region, National Association of Corrosion Engineers, at the Mayo Hotel, Tulsa, Okla. Executive secretary of the Association, 1061 M & M Bldg., Houston 2, Tex. . . . . **OCTOBER 7-9, 1953.**

INDUSTRIAL HYDRAULICS CONFERENCE—Ninth annual National Conference on Industrial Hydraulics, sponsored by the Illinois Institute of Technology, at Sheraton Hotel, Chicago, Ill. Otmar E. Teichmann, conference director, Illinois Institute of Technology, Chicago 16, Ill. . . . . **OCTOBER 8-9, 1953.**

AGA CONFERENCE—Annual conference of the American Gas Association, at Kiel Auditorium, St. Louis, Mo. Secretary of the Association, 420 Lexington Ave., New York, N. Y. . . . . **OCTOBER 26-28, 1953.**

CONTRACTORS CONVENTION—Annual convention of the Refrigeration & Air Conditioning Contractors Association, at the Carter Hotel, Cleveland, Ohio. Secretary of the Association, 228 N. LaSalle St., Chicago 1, Ill. . . . **NOVEMBER 8-11, 1953.**

ALL-INDUSTRY EXPOSITION—8th All-Industry Refrigeration & Air Conditioning Exposition, at the Public Auditorium, Cleveland, Ohio. Geo. E. Mills, show director, 1346 Connecticut Ave., Washington 6, D. C. . . . . **NOVEMBER 9-12, 1953.**

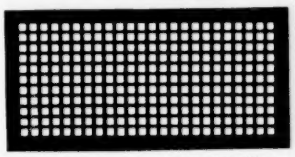
LEADING CONTRACTORS prefer Auer "K" ALL STEEL REGISTERS for walls or ceilings—

HERE'S WHY:

Auer Fig. K Steel Register

1. *Greater Strength*—All Steel construction—heavy gauge steel face. Built to take punishment!
2. *Neater Appearance*—Inconspicuous flush-wall installation. Plain lattice pattern. Stainless steel, bronze, aluminum, chromium or prime finish faces for painting to match any decorative scheme.
3. *Easier Maintenance*—Flat surface cleans as easily as surrounding wall. Trouble-free working mechanism.
4. *Other Features*—Patented spring lock louvre adjustment—easy to operate, non-slipping, positive. Keylock, pole or pulley operated. Available with multiple units behind a single, continuous face. Auer perforated grilles with matching lattice pattern available in any size.

Auer Fig. KP Pulley-Operated Register



Auer Matching Perforated Grille

Write for the "Auer Register Book".

Auer REGISTERS and GRILLES

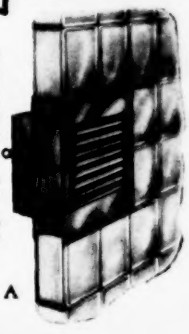
THE AUER REGISTER CO.
6600 Clement Ave. • Cleveland 5, Ohio

Canadian Distributors
Marchand Furnace Ltd., Tilbury, Ont.

YOUR PLANT WILL PERK UP WITH FRESH AIR INSIDE!

and it's so easy with MUCKLE FRESH AIR INTAKES

Perk up- fresh up- with F A I- fresh air inside! Get efficiency with economy by installing MUCKLE FRESH AIR INTAKES — they'll supply fresh, filtered air to each room and condition your plant for *top* efficiency without the expense of costly distribution ducts. Muckle Intakes contain inverted v baffels to arrest direct blow through, oiled spun glass filters and adjustable closing louvers on inside.



A

Model A fits easily into glass block construction by removing 4 blocks. Model B fits any wall thickness. Both models have air opening of 10" x 14" and pass 1000 CFM at .0625" static air pressure.

B

Muckle

WRITE TODAY
For complete information on Muckle Fresh Air Intakes.

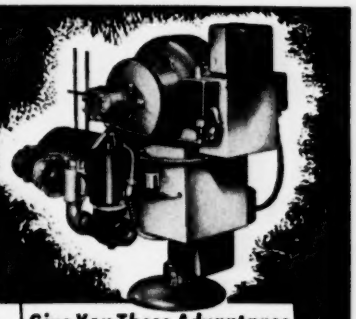
MANUFACTURING CO. OWATONNA 3, MINNESOTA

Now! A DUAL FUEL BURNER
Engineered To Insure Peak Efficiency With Both Fuels

GAS and OIL

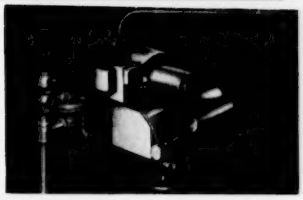
Siemon Power Combi-Matic Burner
employs the forced-draft principle for firing on both gas and oil.

SIEMON Bonus Built* Burners
offer more to you . . . more to your customers.



*Bonus Built Features...	Give You These Advantages
Factory Assembled	Less installation time required.
Factory Tested—for Both Gas and Oil	Insures top "on the job" performance.
Automatic Air Adjustment	Just set it . . . forget it . . .
Motorized Gas Valve	Quiet start-ups; actuates air dampers to correct position.
Automatic Ignition Transformer	Automatic ignition for BOTH fuels.
Uses Standard Controls	Parts always accessible immediately.
Electronic safeguard	Immediate response to flame interruption.
Pressure Safety Control	Prevents opening of either fuel valve unless fan is running and pump pressure proven.
Optional Automatic or Manual Changeover	Will switch automatically from outside temperature or by the flip of a switch.

Model FGO-2200-E
Boiler fired at 2,000,000 B.T.U. input—gas and oil installation in a large Midwestern paper distributing plant

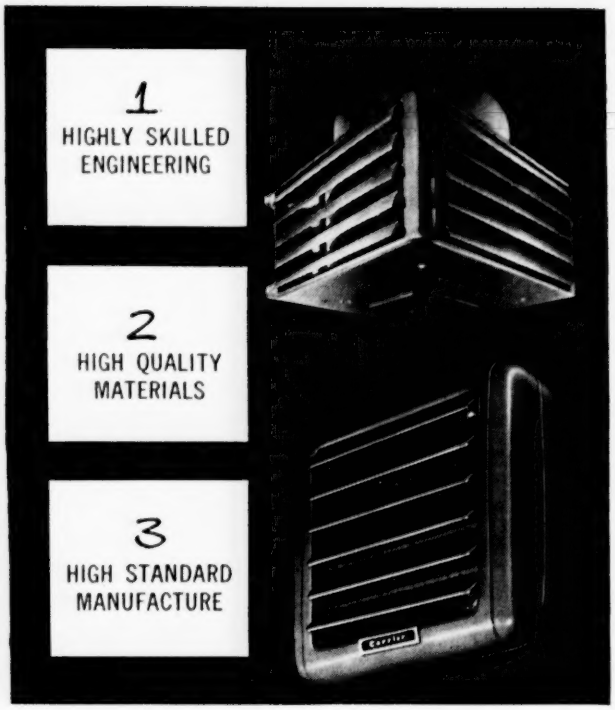


Siemon Power Combi-Matic DUAL FUEL BURNERS

Siemon Manufacturing Co.
1819 Holmes, Dept. T Kansas City, Mo.

Please rush literature and "profit plan" details about your Forced Draft Dual Fuel Burner.

Name_____
Company_____
Address_____
City_____ Zone____ State____



They make the difference in

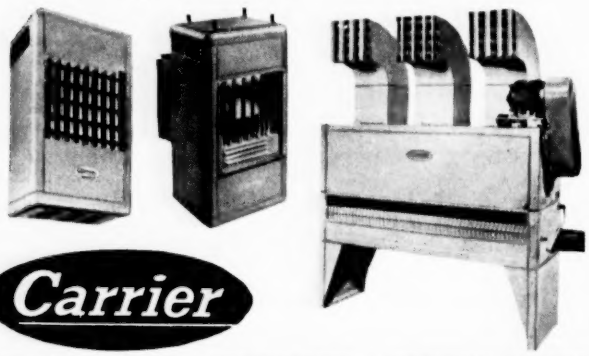
Carrier Unit Heaters

. . . a difference that is fundamental; that leaves no doubt about the high efficiency, economical operation and long-lasting construction of these sturdy steam (or hot water) space heating units.

For higher ceiling installation the *Carrier Four-way Directed-flo Unit Heater* has no superior for flexibility. It fan-propels warmed air in any or all four directions; at any angle, up or down; in any volume. It has both ruggedness and good styling. Seven sizes, 82,400 to 502,000 Btu's.

For directional fan-propelled warm air distribution from heights up to 18 feet, the modern-design *Carrier Horizontal Discharge Unit Heater* is unexcelled for use in stores, salesrooms, restaurants. Ten sizes, 21,000 to 200,000 Btu's.

WRITE FOR FURTHER INFORMATION on the above, or on any of the units shown below: Carrier Heat Diffuser (right); Carrier Gas-fired Unit Heaters (fan propelled and duct types). Address Carrier Corporation, Syracuse, New York.



Carrier

AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

DEGREE-DAYS FOR MAY, 1953

(A) Airport readings; (C) city office readings; (O) Readings at a point on outskirts of city.

HEATING AND VENTILATING'S 25th Year of Publication of Monthly Degree-Day Data

City	May		
	1953	1952	Normal
Abilene, Texas (A)	72	26	0
Albany, New York (A)	183	320	183
Albuquerque, New Mexico (A)	200	58	40
Alpena, Michigan (C)	403	436	465
Anaconda, Montana (C)	614	460	517
Asheville, North Carolina (C)	30	61	71
Atlanta, Georgia (C)	8	18	0
Atlantic City, New Jersey (C)	116	159	220
Augusta, Georgia (A)	0	11	0
Baker, Oregon (C)	(a)	364	431
Baltimore, Maryland (C)	38	77	22
Billings, Montana (A)	424	266	316
Binghamton, New York (C)	180	311	254
Birmingham, Alabama (A)	7	20	0
Bismarck, North Dakota (A)	390	297	338
Block Island, Rhode Island (A)	285	315	378
Boise, Idaho (A)	395	235	236
Boston, Massachusetts (A)	215	238	245
Bozeman, Montana (C)	574	431	471
Buffalo, New York (A)	276	339	335
Burlington, Iowa (A)	203	174	(a)
Burlington, Vermont (A)	231	402	273
Butte, Montana (C)	607	434	502
Cairo Illinois (C)	48	46	0
Charleston, South Carolina (C)	0	2	0
Charlotte, North Carolina (C)	1	22	0
Chattanooga, Tennessee (A)	15	33	0
Cheyenne, Wyoming (A)	530	408	446
Chicago, Illinois (C)	225	251	254
Cincinnati, Ohio (C)	30	86	0
Cleveland, Ohio (A)	129	222	220
Columbia, Missouri (A)	127	110	22
Columbia, South Carolina (C)	0	11	0
Columbus, Ohio (C)	73	130	87
Concord, New Hampshire (A)	247	364	298
Concordia, Kansas (C)	194	99	65
Dallas, Texas (A)	42	14	0
Davenport, Iowa (C)	(a)	167	118
Dayton, Ohio (A)	88	163	81
Deer Lodge, Montana (C)	582	415	487
Denver, Colorado (C)	353	253	267
Des Moines, Iowa (A)	203	188	118
Detroit, Michigan (A)	188	235	226
Devils Lake, North Dakota (C)	391	337	424
Dodge City, Kansas (A)	201	105	47
Dubuque, Iowa (C)	261	249	149
Duluth, Minnesota (C)	516	421	521
Eastport, Maine (A)	493	512	543
Elkins, West Virginia (A)	72	224	177
El Paso, Texas (A)	64	14	0
Ely, Nevada (A)	687	394	(a)
Erie, Pennsylvania (C)	232	308	257
Escanaba, Michigan (C)	445	391	440
Evansville, Indiana (A)	53	87	0
Fargo, North Dakota	331	301	327
Fort Smith, Arkansas (A)	52	29	0
Fort Wayne, Indiana (A)	133	233	130
Fort Worth, Texas (A)	42	10	0
Fresno, California (A)	127	24	0
Galveston, Texas (C)	0	0	0
Grand Junction, Colorado (A)	276	109	118
Grand Rapids, Michigan (A)	214	235	174
Green Bay, Wisconsin (C)	339	335	322
Greensboro, North Carolina (A)	7	41	0
Greenville, South Carolina (A)	2	27	0
Harrisburg, Pennsylvania (A)	71	156	90
Hartford, Connecticut (A)	164	256	202
Hatteras, North Carolina (C)	2	3	0
Havre, Montana (C)	420	236	369
Helena, Montana (A)	516	368	402
Houston, Texas (C)	3	0	0
Huron, South Dakota (A)	298	242	267
Indianapolis, Indiana (A)	79	144	59
Jackson, Mississippi (A)	3	8	(a)
Kansas City, Missouri (A)	149	91	6
Knoxville, Tennessee (A)	21	43	0
La Crosse, Wisconsin (A)	228	253	183
Lander, Wyoming (A)	542	360	428
Lansing, Michigan (A)	195	274	229

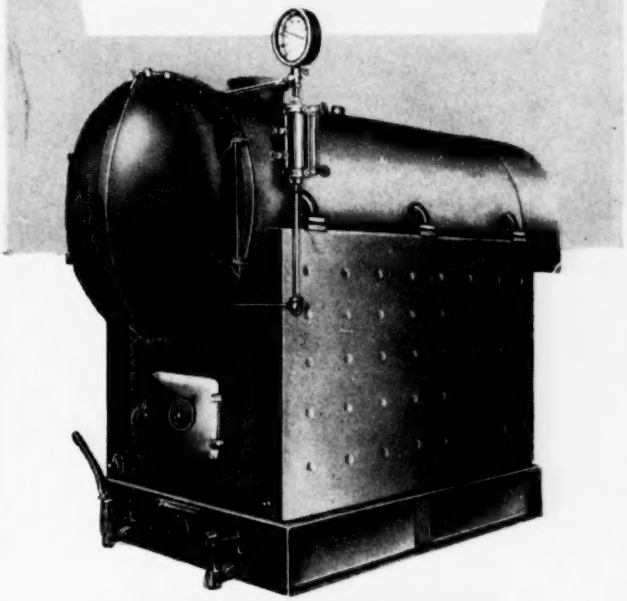
(a) Data not available.

City	May		
	1953	1952	Normal
Lewiston, Maine (O)	240	324	344
Lincoln, Nebraska (C)	193	126	99
Little Rock, Arkansas (A)	40	25	0
Livingston, Montana (C)	568	398	405
Los Angeles, California (C)	82	10	90
Louisville, Kentucky (A)	34	74	0
Lynchburg, Virginia (A)	12	65	0
Macon, Georgia (A)	1	11	0
Madison, Wisconsin (C)	267	235	236
Marquette, Michigan (C)	461	469	496
Memphis, Tennessee (A)	31	20	0
Meridian, Mississippi (A)	0	16	0
Milwaukee, Wisconsin (A)	302	333	350
Minneapolis, Minnesota (A)	237	224	236
Moline, Illinois	204	195	(a)
Montgomery, Alabama (A)	3	11	0
Nantucket, Massachusetts (A)	345	335	384
Nashville, Tennessee (A)	14	47	0
New Haven, Connecticut (A)	196	256	223
New Orleans, Louisiana (C)	0	0	0
New York, New York (C)	116	176	171
Newark, New Jersey	107	160	162
Norfolk, Virginia (C)	2	22	0
North Head, Washington (C)	(a)	417	422
North Platte, Nebraska (A)	299	224	199
Oakland, California (C)	227	165	205
Oklahoma City, Oklahoma (C)	103	40	0
Omaha, Nebraska (A)	186	138	84
Oswego, New York (C)	(a)	401	357
Parkersburg, West Virginia (C)	20	101	53
Peoria, Illinois (A)	172	184	121
Philadelphia, Pennsylvania (C)	71	110	115
Phoenix, Arizona (C)	5	0	0
Pittsburgh, Pennsylvania (C)	48	158	78
Pocatello, Idaho (A)	494	520	332
Portland, Maine (A)	341	406	366
Portland, Oregon (C)	276	198	245
Providence, Rhode Island (A)	214	220	251
Pueblo, Colorado (A)	274	173	186
Raleigh, North Carolina (C)	0	29	0
Rapid City, South Dakota (A)	392	278	344
Reading, Pennsylvania (C)	71	130	96
Red Bluff, California (A)	128	46	(a)
Reno, Nevada (A)	527	290	366
Richmond, Virginia (C)	4	51	0
Rochester, New York (A)	254	325	260
Roswell, New Mexico (A)	108	54	0
Sacramento, California (C)	143	78	53
St. Joseph, Missouri (A)	178	118	16
St. Louis, Missouri (C)	68	85	0
Salt Lake City, Utah (A)	367	151	236
San Antonio, Texas (A)	19	0	0
San Diego, California (A)	94	32	115
Sandusky, Ohio (C)	148	197	183
San Francisco, California (C)	265	239	264
Sault Ste. Marie, Michigan (A)	435	518	502
Savannah, Georgia (A)	0	8	0
Scranton, Pennsylvania (C)	142	244	171
Seattle, Washington (C)	275	258	316
Sheridan, Wyoming (A)	476	298	403
Shreveport, Louisiana (A)	16	7	0
Sioux City, Iowa (A)	209	186	164
Spokane, Washington (A)	383	256	285
Springfield, Illinois (C)	99	129	56
Springfield, Missouri (A)	125	96	12
Syracuse, New York (A)	225	327	267
Tacoma, Washington (C)	(a)	309	322
Terre Haute, Indiana (A)	89	141	0
Toledo, Ohio (A)	149	226	180
Topeka, Kansas (C)	163	96	34
Trenton, New Jersey (C)	108	154	81
Utica, New York (O)	230	365	253
Valentine, Nebraska (C)	324	251	273
Walla Walla, Washington (C)	232	136	171
Washington, D. C. (C)	16	69	25
Wichita, Kansas (A)	156	71	0
Williston, North Dakota (C)	433	294	362
Winnemucca, Nevada (C)	550	318	324
Yakima, Washington (A)	306	197	186

(a) Data not available.

Figures in this table, with seven exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y.; and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company.

✓ COMPACT
✓ ECONOMICAL
✓ Engineered for Better Service



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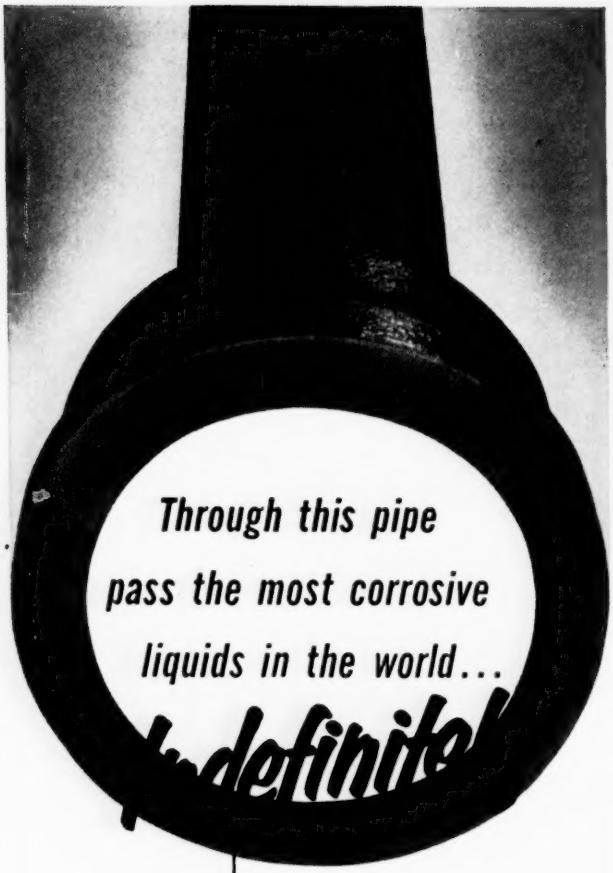

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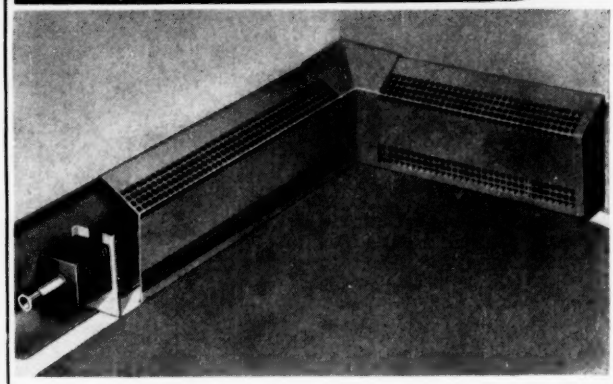

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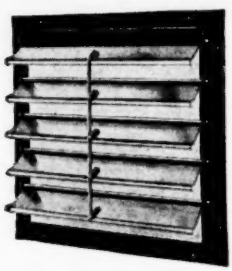

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Attention Wm. Dackis
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WANTED

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HEAT RADIATING AREA OF BUTT WELD PIPE FITTINGS*

(STANDARD WEIGHT)

Pipe Diameter, Inches	Long Radius 90° Elbow		Short Radius 90° Elbow		Long Radius 45° Elbow		Cap	
	Area, Sq. Ft.	Equiv. Pipe Length, Ft.	Area, Sq. Ft.	Equiv. Pipe Length, Ft.	Area, Sq. Ft.	Equiv. Pipe Length, Ft.	Area, Sq. Ft.	Equiv. Pipe Length, Ft.
½	.04	.18	...	...	.02	.09	...	...
¾	.04	.15	...	...	.02	.07	.01	.04
1	.07	.20	.05	.15	.03	.09	.02	.06
1¼	.11	.25	.07	.16	.05	.12	.02	.05
1½	.15	.30	.10	.20	.07	.14	.02	.04
2	.24	.39	.16	.26	.12	.19	.03	.05
2½	.37	.49	.25	.33	.19	.25	.04	.05
3	.54	.59	.36	.39	.27	.29	.06	.07
3½	.72	.69	.48	.46	.36	.34	.09	.09
4	.93	.79	.62	.53	.46	.39	.10	.08
5	1.43	.98	.95	.65	.72	.49	.16	.11
6	2.04	1.18	1.36	.78	1.02	.59	.22	.13
8	3.55	1.57	2.37	1.05	1.77	.78	.34	.15
10	5.53	1.96	3.69	1.31	2.26	.80	.52	.18
12	7.87	2.35	5.25	1.57	3.93	1.18	.74	.22
14	10.08	2.52	6.72	1.68	5.04	1.26	.89	.22
16	13.16	2.90	8.79	1.93	6.58	1.45	1.21	.26
18	16.66	3.50	11.11	2.33	8.33	1.75	1.42	.30
20	20.56	3.91	13.72	2.61	10.28	1.95	1.77	.34
24	29.61	4.74	19.75	3.16	14.82	2.37	2.50	.40
30	46.27	...	30.86	...	23.13	...	...	..

Pipe Diameter, Inches	Long Radius 180° Elbow		Short Radius 180° Elbow		Cross†		Tee†	
	Area, Sq. Ft.	Equiv. Pipe Length, Ft.	Area, Sq. Ft.	Equiv. Pipe Length, Ft.	Area, Sq. Ft.	Equiv. Pipe Length, Ft.	Area, Sq. Ft.	Equiv. Pipe Length, Ft.
½	.09	.41	...	...	...	...	.04	.18
¾	.08	.29	...	...	...	...	.06	.22
1	.14	.41	.09	.26	...	...	.10	.29
1¼	.21	.48	.14	.32	.18	.41	.16	.37
1½	.29	.47	.20	.32	.26	.42	.22	.35
2	.49	.65	.33	.44	.33	.44	.30	.40
2½	.74	.81	.49	.53	.50	.55	.43	.47
3	1.08	1.03	.72	.69	.63	.60	.57	.54
3½	1.44	1.22	.96	.91	.79	.67	.72	.61
4	1.85	1.57	1.23	1.04	.96	.81	.88	.75
5	2.86	1.96	1.91	1.31	1.36	.93	1.27	.87
6	4.09	2.36	2.72	1.57	1.82	1.05	1.72	.99
8	7.09	3.14	4.73	2.10	2.84	1.26	2.74	1.21
10	11.05	3.92	7.37	2.62	4.20	1.49	4.09	1.45
12	15.73	4.70	10.49	3.14	5.81	1.74	5.69	1.70
14	20.15	5.04	13.42	3.36	7.04	1.76	6.88	1.72
16	26.32	5.79	17.56	3.86	8.39	1.85	8.38	1.84
18	33.31	7.00	22.22	4.67	10.62	2.23	10.61	2.23
20	41.13	7.81	27.43	5.21	13.11	2.49	13.10	2.49
24	59.22	9.48	39.50	6.32	16.79	2.69	17.29	2.77
30	92.53	...	61.72	...	...	...	...	...

*Pipe length is the equivalent length of Schedule 40 pipe, same size, of area given in adjacent column.
†Data for crosses and tees are approximations only.

HEAT RADIATING AREA OF FLANGED PIPE FITTINGS

HEAT RADIATING AREA OF STANDARD WEIGHT FLANGED FITTINGS*

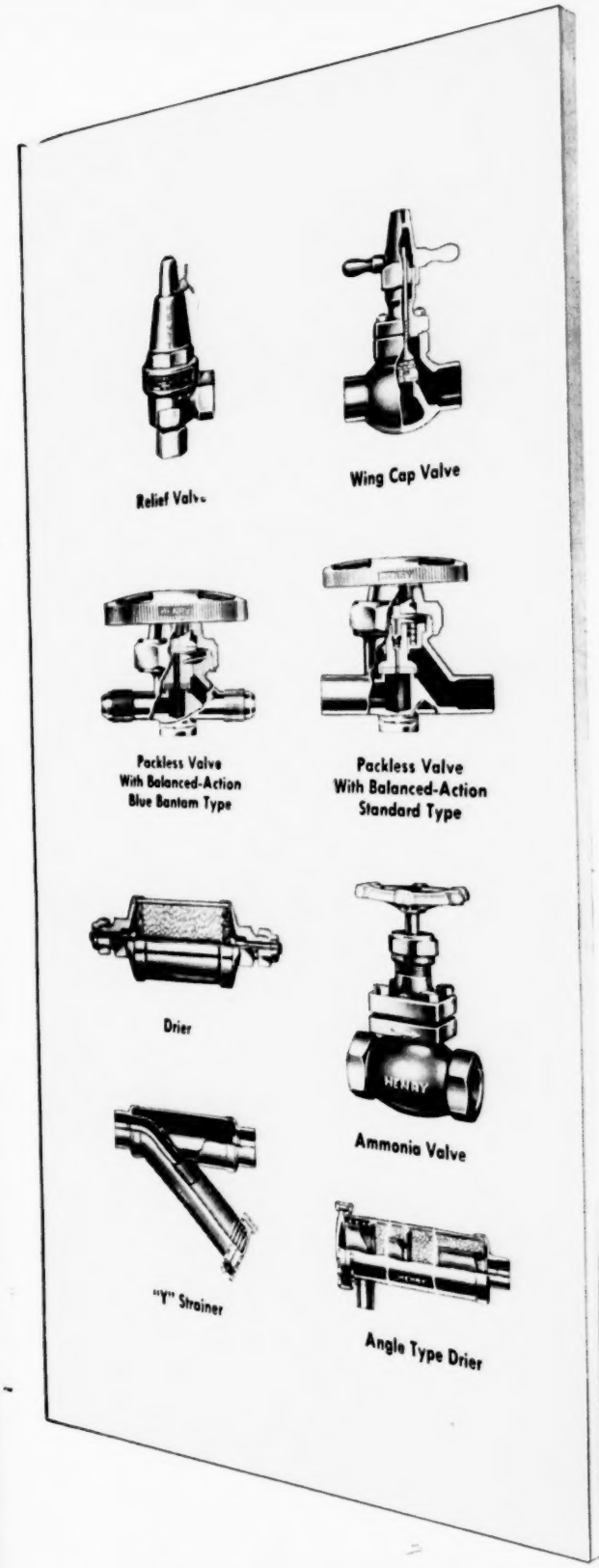
Pipe Diameter, Inches	Flanged Couplings		90° Elbow		Long Radius Elbow		Tee		Cross	
	Area, Sq. Ft.	Equiv. Pipe Length, Ft.	Area, Sq. Ft.	Equiv. Pipe Length, Ft.	Area, Sq. Ft.	Equiv. Pipe Length, Ft.	Area, Sq. Ft.	Equiv. Pipe Length, Ft.	Area, Sq. Ft.	Equiv. Pipe Length, Ft.
1	.32	.93	.79	2.31	.89	2.59	1.24	3.59	1.62	4.72
1¼	.38	.88	.96	2.20	1.08	2.49	1.48	3.40	1.94	4.47
1½	.48	.95	1.17	2.35	1.34	2.68	1.82	3.64	2.38	4.78
2	.67	1.08	1.65	2.65	1.84	2.96	2.54	4.08	3.32	5.34
2½	.84	1.12	2.09	2.78	2.32	3.08	3.21	4.26	4.19	5.56
3	.95	1.03	2.38	2.60	2.68	2.93	3.66	3.99	4.77	5.70
3½	1.12	1.07	2.98	2.85	3.28	3.13	4.48	4.28	5.83	5.56
4	1.34	1.14	3.53	2.90	3.96	3.36	5.41	4.59	7.03	5.97
4½	1.47	1.13	3.95	3.01	4.43	3.38	6.07	4.63	7.87	6.01
5	1.62	1.11	4.44	3.05	5.00	3.43	6.81	4.67	8.82	6.06
6	1.82	1.05	5.13	2.95	5.99	3.45	7.84	4.53	10.08	5.81
7	2.17	1.05	6.17	3.09	7.38	3.70	9.37	4.69	12.00	6.01
8	2.41	1.07	6.98	3.09	8.56	3.79	10.55	4.67	13.44	5.96
9	3.00	1.19	8.71	3.46	10.57	4.20	13.18	5.23	16.78	6.66
10	3.43	1.22	10.18	3.61	12.35	4.38	15.41	5.47	19.58	6.95
12	4.41	1.32	13.08	3.92	16.35	4.90	19.67	5.89	24.87	7.45
14	5.39	1.47	16.38	4.47	20.17	5.47	24.81	6.78	31.48	8.60
16	6.69	1.60	20.17	4.82	25.41	6.07	30.32	7.23	38.34	9.15

*Pipe length is the equivalent length of Schedule 40 pipe, same size, of area given in adjacent column.

HEAT RADIATING AREA OF EXTRA-HEAVY FLANGED FITTINGS†

Pipe Diameter, Inches	Flanged Couplings		90° Elbow		Long Radius Elbow		Tee		Cross	
	Area, Sq. Ft.	Equiv. Pipe Length, Ft.	Area, Sq. Ft.	Equiv. Pipe Length, Ft.	Area, Sq. Ft.	Equiv. Pipe Length, Ft.	Area, Sq. Ft.	Equiv. Pipe Length, Ft.	Area, Sq. Ft.	Equiv. Pipe Length, Ft.
1	.44	1.27	1.02	2.95	1.08	3.15	1.58	4.58	2.07	6.02
1¼	.51	1.17	1.10	2.52	1.34	3.08	1.93	4.43	2.52	5.82
1½	.73	1.46	1.33	2.67	1.87	3.76	2.68	5.38	3.54	7.11
2	.85	1.36	2.01	3.23	2.16	3.47	3.09	4.97	4.06	6.53
2½	1.11	1.46	2.57	3.41	2.76	3.67	4.05	5.38	5.17	6.87
3	1.48	1.62	3.49	3.81	3.74	4.08	5.33	5.82	6.95	7.58
3½	1.64	1.57	3.96	3.78	4.28	4.09	6.04	5.77	7.89	7.54
4	1.91	1.62	4.64	3.94	4.99	4.24	7.07	6.00	9.24	7.84
4½	2.04	1.56	5.02	3.83	5.46	4.17	7.72	5.90	10.07	7.69
5	2.18	1.50	5.47	3.76	6.02	4.13	8.52	5.85	10.97	7.53
6	2.78	1.60	6.99	4.03	7.76	4.48	10.64	6.14	13.75	7.93
7	3.46	1.73	8.62	4.32	9.73	4.87	12.33	6.18	16.83	8.43
8	3.77	1.67	9.76	4.32	11.09	4.91	14.74	6.53	18.97	8.41
9	4.44	1.76	11.44	4.54	13.17	5.23	17.23	6.84	22.10	8.77
10	5.20	1.85	13.58	4.82	15.60	5.54	20.41	7.25	26.26	9.32
12	6.71	2.01	17.73	5.31	18.76	5.62	26.65	7.99	34.11	10.22
14	8.30	2.26	22.31	6.08	25.70	7.02	33.63	9.18	43.15	11.75
16	10.05	2.40	27.18	6.48	31.73	7.58	40.94	9.78	52.35	12.50

†Pipe length is the equivalent length of Schedule 80 pipe, same size, of area given in adjacent column.



Relief Valve

Wing Cap Valve

Packless Valve
With Balanced-Action
Blue Bantam Type

Packless Valve
With Balanced-Action
Standard Type

Drier

Ammonia Valve

"Y" Strainer

Angle Type Drier

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Low water cut-offs on hot water boilers?

The industry has given the answer . . .

WE LEARNED recently that for more than two years a consulting engineer in Ohio has been specifying McDonnell No. 150 Low Water Fuel Cut-offs for every one of his hot water heating boilers. The No. 150 is designed for pressures through 150 pounds, and is really more than he needs. When we told him that he should have specified our No. 63, designed especially for hot water heating, he was amazed . . . wanted to know why we had been keeping the No. 63 a secret.

We're not: The No. 63 and its excellent teammate are illustrated below, but frankly this matter of water level control for hot water space heating boilers is a subject we have been inclined to leave largely in the hands of the engineers and contractors.

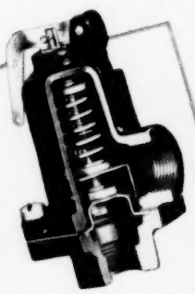
We had a reason for this. Years ago when we first broached the idea, some heating men seemed to think we were taking in too much territory . . . that we should stick to the good old steam field. So we just set up a few sound reasons for using water level controls on hot water heating boilers and then awaited developments.

We didn't have to wait long. Apparently those who came to jeer remained to praise; for all we know this Ohio consulting engineer may have been one of them. Today we don't need to speak up on this matter; the industry is speaking for us. An engineer in California who knows his equipment thoroughly puts both a McDonnell Boiler Feeder *and* a No. 63 low water cut-off on all hot water jobs. A contractor played back to us practically our own words when he wrote: "A pressure reducing valve feeds make-up water only under normal conditions. When an emergency develops and the boiler pressure is higher than the reducing valve setting you no longer have make-up and you need something to stop the firing and save the boiler."

That something is the No. 63 described below . . . and while you're at it, don't forget the No. 230—30. We have automatic water feeders especially adapted to hot water boilers too — but this is another subject, fully covered by our Bulletin L-113. Ask for complete details on this ever broadening field.

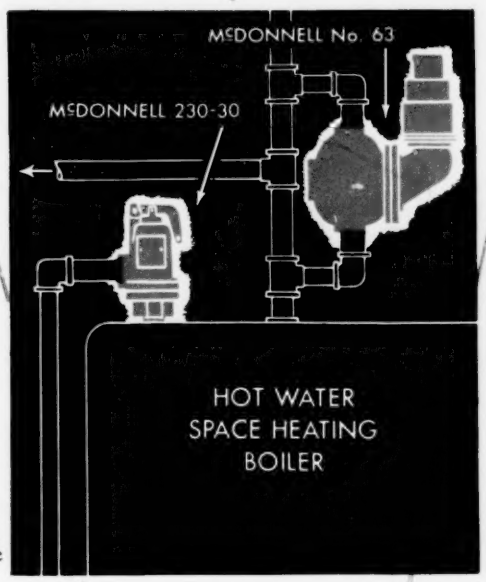
McDONNELL & MILLER, *Inc.*, 3500 North Spaulding Avenue, Chicago 18, Illinois

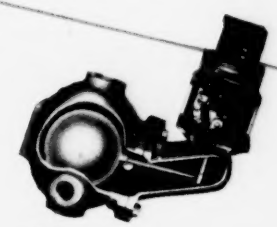
Doing One Thing Well



McDONNELL 230-30 PRESSURE RELIEF VALVE

Here is the 30 lb. relief valve for the vast majority of hot water heating boilers — boilers with gross Btu output up to 303,000 Btu per hr. It conforms to all requirements of the ASME Boiler Code; has been tested and rated by the National Board of Boiler and Pressure Vessel Inspectors. All interior operating parts are non-ferrous metals; valve disc, Silicone; seat, brass. Here is a thoroughly dependable valve, fully worthy of the McDonnell name, yet sold at a very moderate price as a result of large scale production. Larger capacity valves are available for larger boilers.





McDONNELL No. 63 LOW WATER FUEL CUT-OFF

We designed this low water cut-off especially for hot water heating boilers. It gives you a fuel cut-off of real McDonnell quality for pressures up to 50 pounds at a moderate price. The cut-off switch is the respected McDonnell No. 2. Heavy-duty Syphon eliminates packing. Float action is transmitted through knife-edged stainless steel bearings — a typical McDonnell refinement. Electrical ratings: A.C. ¾ hp., 115-230V; D.C. 10 Amp. 115V.

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McDONNELL *Boiler Water Level Controls*